Welding Engineer

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APRIL, 1955

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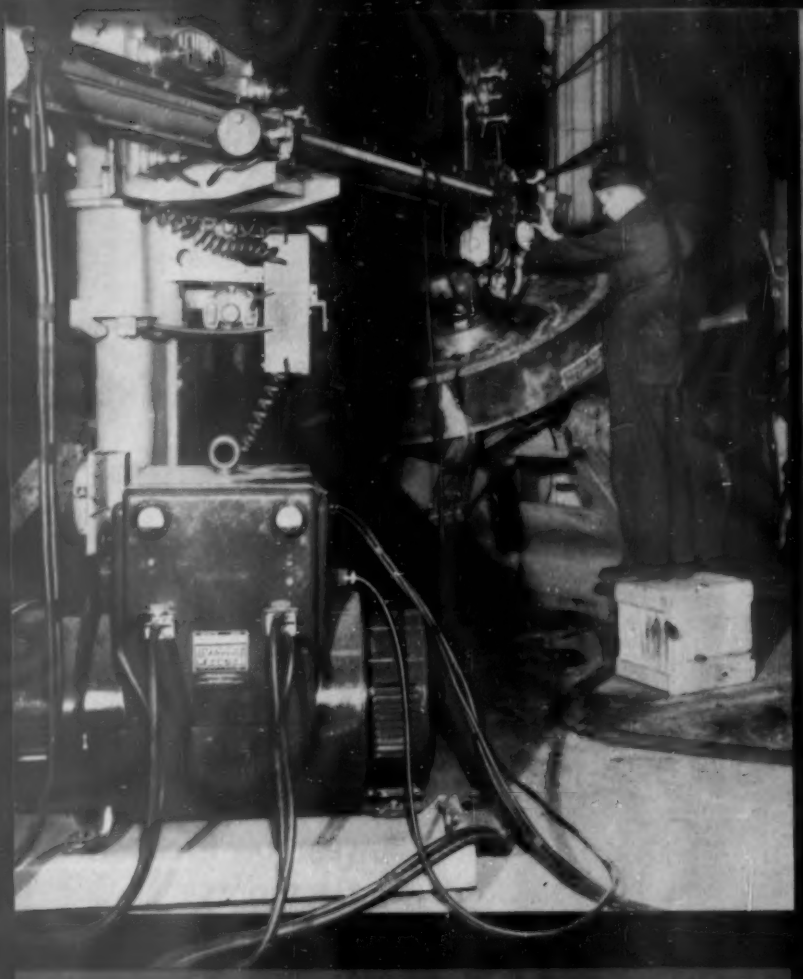

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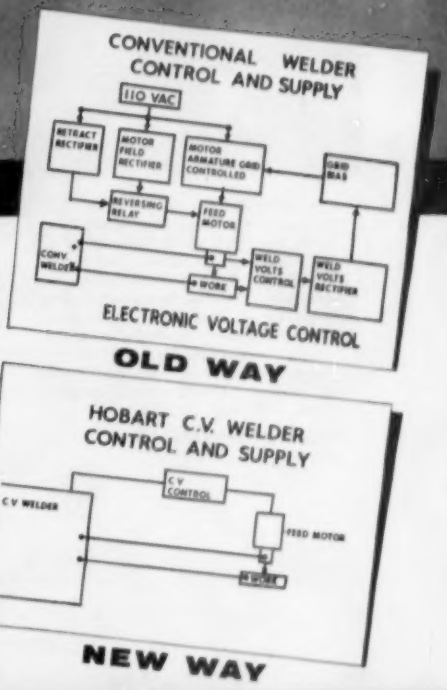

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Welding Engineer

April, 1955
Vol. 40—No. 4

A MAGAZINE OF JOINING AND SEVERING OF METALS

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12 East Grand Avenue
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Single copies 35 cents. Subscription rates: United States and possessions $3 per year; $4 for two years; $5 for three years. Canada $5 per year, $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of March 3, 1879. Printed in U. S. A.

WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

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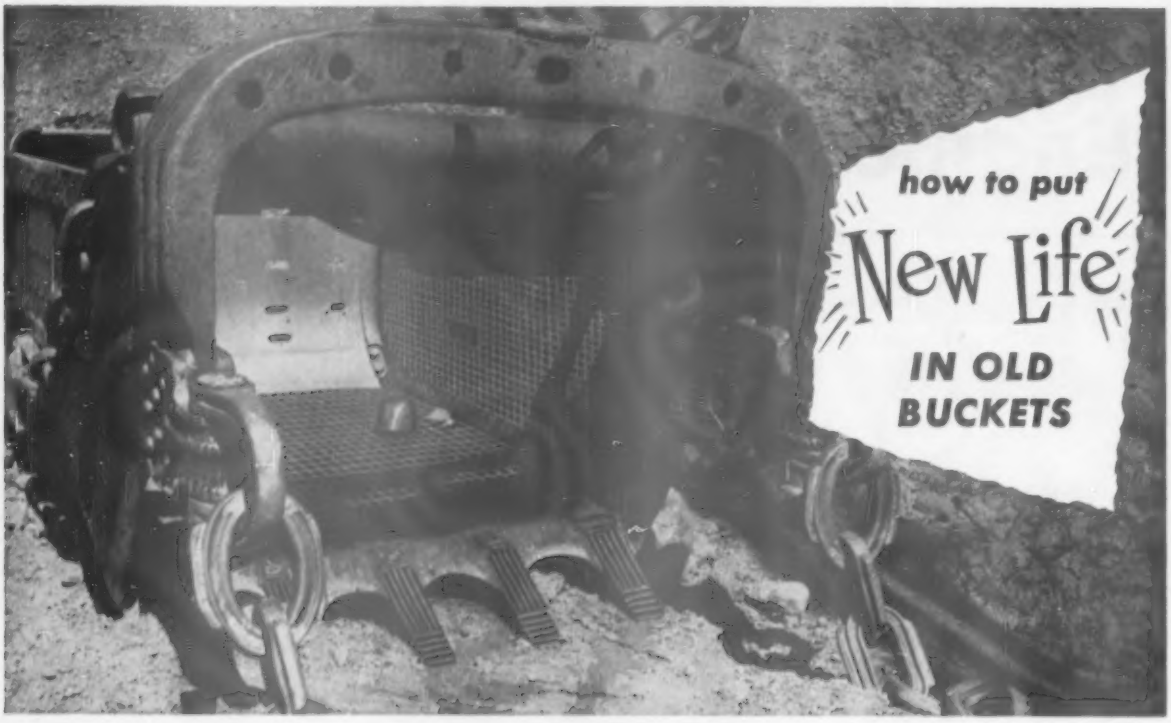

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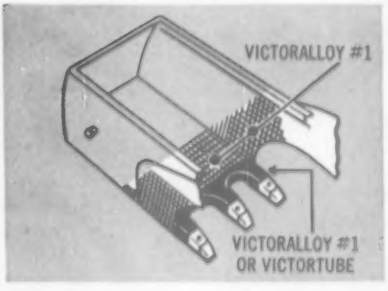

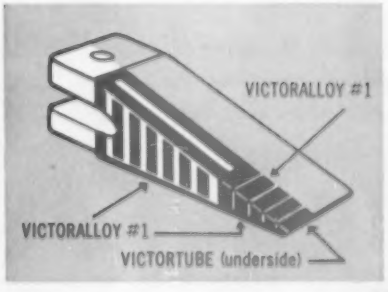

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Teeth . . . Apply VICTORTUBE to underside from point upward about 2", and VICTORALLOY #1 to upper side of tooth same distance. Use stringer beads of VICTORALLOY #1 on balance of upper and lower surfaces, and on edges. Use 3/16" coated VICTORTUBE at 130 to 160 amperes, a.c. or reverse-polarity d.c., and 3/16" coated VICTORALLOY at 170 to 190 amperes, a.c. or d.c.

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J. H. HUMBERSTONE, AWS president, receives award from D. F. Lane, vice-president of National Foremen's Institute

NEW Coyne Cylinder Co. building in Memphis, Tenn., covers 14,000 sq ft and also has 18,000 sq ft of yard space

NEWS

FOA presents award to American Welding Society

J. H. Humberstone, president of the American Welding Society and Air Reduction Sales Co., New York City, recently accepted a Certificate of Cooperation awarded AWS by the Foreign Operations Administration.

The award, signed by Harold E. Stassen, director of FOA, was made because of the significant contribution made by AWS in furnishing technical assistance to representatives of countries cooperating in the FOA program.

The Icelandic team, which has just completed an eleven-week project of welding study in this country under the auspices of FOA, was present at the ceremonies. The tour of this group, headed by Jon S. Jonsson (left in picture above), was arranged by the National Foremen's Institute, Inc.

* * *

Mid-States Welder Mfg. Co. gains all assets of Viking

Mid-States Welder Mfg. Co., Chicago, has just acquired the complete assets of the Viking Welding Sales Co., Detroit. This purchase includes all patent rights, manufacturing equipment, etc., according to an announcement by W. W. Jetter, president of Mid-States.

The new line of welders comprises three different types: straight a-c transformer welders ranging in sizes up to 500 amp; inert-gas unit a-c welders of 200 and 300-amp rated capacity; and d-c rectifier machines of 200, 300 and 400-amp capacity, together with remote control devices for d-c rectifier units. With this acquisition, Mid-States will be able to provide a wider range of welding requirements.

This equipment will be manufactured by Mid-States Welder in its own plant at 6025 S. Ashland Ave., Chicago.

* * *

AWS Section to sponsor arc welding symposium

The Saginaw Valley Section of American Welding Society will sponsor an automatic arc welding symposium on May 12, in Flint, Mich. The symposium will cover both the submerged-arc and the inert-gas processes.

* * *

Squeeze in copper supplies unrelated to Formosa situation

The present squeeze on copper users is not the result of developments in Formosa, according to the Copper & Brass Warehouse Ass'n. The real reason for the shortage is labor disputes in African mines. Because of this dispute, the price of copper in Europe has been rising for months.

This combination of high London prices and temporary dislocations of the mines has caused the change of copper stocks from the U.S. to foreign markets. The whole problem will be solved when the strike in the African copper mines is ended.

Coyne Cylinder Co. erects new building in Memphis

In order to serve southwest, southeast, midwest and eastern markets, Coyne Cylinder Co. has erected a 14,000 sq-ft building at 155 W. Bodley Ave. in Memphis, Tenn.

The new building has air-conditioned sales offices and manufacturing facilities. In addition, the plant has a six-car spur track and 18,000 sq ft of yard space. The firm's other site is the acetylene cylinder manufacturing plant in San Francisco.

* * *

Aluminum brazing and welding color films now available

Two new color films, "New Horizons in Aluminum Brazing" and "Welding Advances with Aluminum" are available for free loan through the regional libraries of Association Film, Inc. They are presented as an industry service by Aluminum Co. of America, Pittsburgh.

"New Horizons in Aluminum Brazing" runs 22 minutes and covers furnace, torch and dip brazing of aluminum. It describes the process, demonstrates the techniques and discusses the use of each process, using current technology.

The other film is a 28-minute description of modern developments in inert-gas and shielded-arc welding of aluminum.

* * *

Wilton Tool purchases Rapid Titan Mfg. Co.

In a recent purchase of all assets of Rapid Titan Mfg. Co., Pentwater, Mich., Wilton Tool Co., Chicago, has gained control of a patent which incorporates a basic improvement in rapid acting nuts.

NEWS

from page 5

—Courtesy A. M. Byers Co.

THE hull of the dredge *Captain Charlie*, 136 ft by 42 ft by 9 ft, is one of the largest ever built in the Morgan City area. The hull which is corrosion resistant, is expected to reduce repair costs and permit longer periods of trouble-free operations

—Photo courtesy Alloy Rods Co.

WELDOR makes double-vee butt girth joint in 1½-in. plate with a new type of low-hydrogen electrode with iron powder in the coating, which can be used in out-of-position work. All of the welds were X-rayed and found free of cracks and porosity

Wrought iron plate used in two vessels

Wrought iron plate was used as engineers of Oyster Shell Products Corp. aimed at the twin benefits of lower-cost maintenance and improved operating efficiency in specifying material for the hull of two vessels, which are of sturdy all-welded construction.

The *Captain Charlie*, a hydraulic dredge, and the *Smith Alpha*, a tugboat, were recently built at the firm's shipyard in Morgan City, La. Their hulls are fabricated of corrosion-resistant wrought iron plate. More than 76 tons of this plate, 5/16 in. to 2 in. thick, are in the hull and keel applications.

* * *

Program announced for NWSA Convention in May

Dr. John O. Christianson, superintendent of the School of Agriculture at the University of Minnesota, will be the featured speaker at the banquet during the National Welding Supply Association's 11th annual convention on May 18, 19 and 20 at the Edgewater Beach Hotel in Chicago. Dr. Christianson will appear under the sponsorship of General Motors Corp.

Speakers on May 18 will include James N. Alcock, president of NWSA; Robert C. Fernley, secretary-treasurer of the organization; Arthur C. Horrocks, public relations counsel for The Goodyear Tire & Rubber Co., Inc., Akron, Ohio; Verne R. Martin, Newton, Iowa; Dr. Robert N. McMurry, McMurry, Hamstra & Co., Chicago; and Glenn G. Garman, chairman, Purity Cylinder Gases, Inc., Grand Rapids, Mich. The business of the day will conclude with the report of the nominating committee and general announcements.

On May 19, Cloyd S. Steinmetz, director of sales training, Reynolds Metals Co., Louisville, Ky.; and William A. Rice, chairman of Virginia Welding Supply Co., Charleston, W. Va., will deliver addresses. Other business will include opening remarks by Mr. Alcock, a panel discussion, election and introduction of officers and directors and general announcements.

May 19 will hear speeches by A. C. Van Dusen, vice-president and director of public relations at Northwestern University, Evanston, Ill.; Phyllis Brown, The Research Institute of America, Inc., New York City; Fred Smith, vice-president—operations of The Gruen Watch Co., Cincinnati; and Leslie P. Beaver, Jr., national chairman of Beaver Welding Supply Co., Memphis.

AWS national spring meeting in Kansas City, June 7-10

Thirty-nine papers on many current practical problems of welding, as well as those on advanced research, will highlight the program of the national spring meeting of the American Welding Society, scheduled for the Hotel Muehlebach, Kansas City, Mo., June 7 to 10.

The spring meeting is held in conjunction with the annual welding show, which will be presented at the Municipal Auditorium in the same city, June 8-10. The show, to be the largest ever held in the welding field, will feature the greatest assemblage of welding equipment and accessories ever gathered.

* * *

AEC to assist industry in development of X-ray unit

The U.S. Atomic Energy Commission recently announced plans to assist private industry in the commercial development of portable thulium X-ray units. Development of a small, relatively inexpensive and portable device by the Argonne National Laboratory, near Lemont, Ill., was announced last spring (see WELDING ENGINEER, August 1954, page 6).

Each unit contains about 200 milli-

(Continued on page 80)

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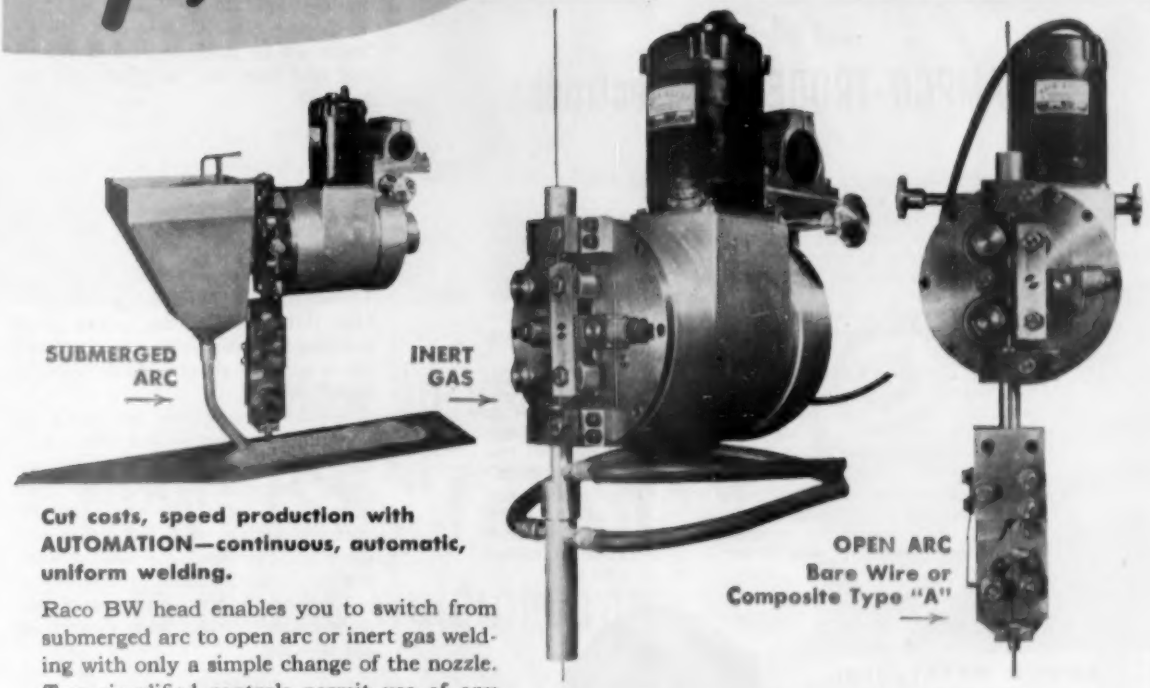

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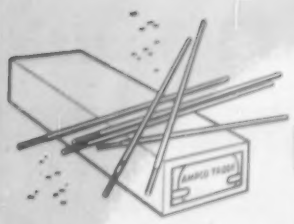

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Versatility? You really get it with Ampco-Trode 10. You make intermediate hardness (130-150 BHN) overlays and inlays that have excellent bearing qualities and high resistance to all forms of wear — metal-to-metal, erosion, cavitation-pitting, etc. The deposit resists corrosion from salt water, acids, mild alkalies.

Get convenient Ampco-Trode electrodes in all sizes 3/32" to 5/16", 11" to 18" lengths. Filler rod and wire also in stock for other welding processes. Be set for those tough welding jobs. Order Ampco-Trode 10 today.

*Reg. U. S. Pat Off.

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Dept. WE-4
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West Coast Plant
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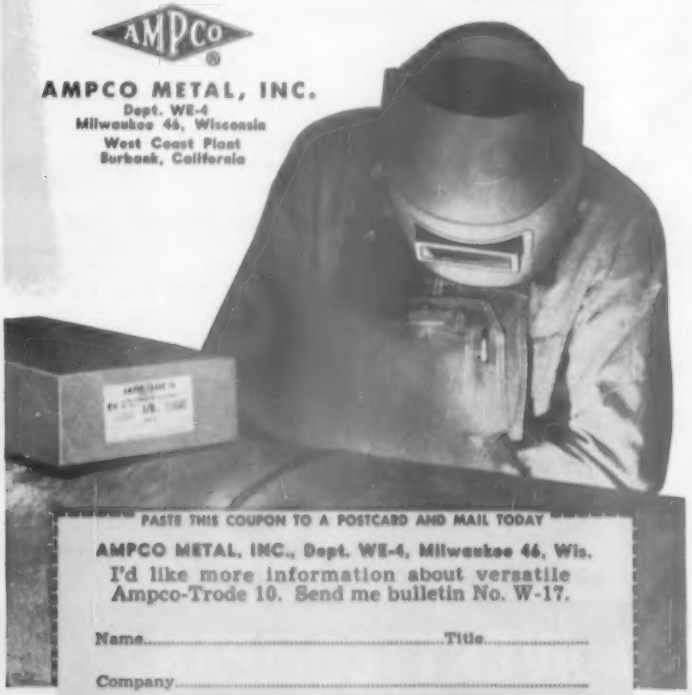


PASTE THIS COUPON TO A POSTCARD AND MAIL TODAY

AMPCO METAL, INC., Dept. WE-4, Milwaukee 46, Wis.
I'd like more information about versatile Ampco-Trode 10. Send me bulletin No. W-17.

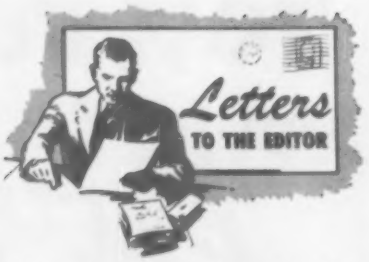
Name..... Title.....

Company.....

Company Address.....

City..... (.....) State.....

W-120



Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if you request.

Leather not nylon

Dear Sir:

We were delighted to see your fine piece on our welding inspection in February's WELDING ENGINEER. ("No stubs or butts in this pipe!") One thing which may puzzle your readers, however, is the comment and photo caption about weldors wearing nylon gloves.

While nylon gloves are worn by pipefitters, inspectors and others who must come into contact with the material, the man handling the torch does not. Evidently we gave your reporter a wrong steer, but as in any other well-run shop, our weldors wear leather gloves for hand protection.

I hope none of your readers across the country burned their fingers on our account.

Sincerely,
R. E. Steele
Public Relations Manager
Electric Boat Div.
General Dynamics Corp.
Groton, Conn.

* * *

Likes "Weldor's Woes"

Dear Sir:

I've gotten quite a charge out of previous cartoons in WELDING ENGINEER'S, "A Weldor's Woes," which depicts the usual plight of the weldor. I especially liked the one in January's issue concerning the clown who has probably taken quite a bit of time and effort putting on a new stinger, only to discover that he forgot the handle. Well, he ain't the only one! However, for myself, I don't do it quite as frequently now as I used to.

I'm surprised you haven't gotten any gripes, because I've never known any weldor to be completely happy.

Sincerely,
Bill Emans

How to use
New USS "T-1" Steel
to reduce welding costs

New USS "T-1" Steel is three times as strong as ordinary mild steel . . . has a yield strength of 90,000 psi.

Yet, despite its very high strength, this new alloy steel is *easy to weld*. It requires neither pre- nor post-heating when you weld or flame cut it. You can use its unique combination of properties to reduce fabricating costs and speed assembly in pressure vessels, construction machinery, mining equipment, bridges, towers, and pipe.

USE "T-1" TO REDUCE THICKNESS. You can take advantage of the exceptionally high yield strength of "T-1" Steel to reduce the size and weight of heavily stressed parts. Weldments on thinner sections take less time . . . and less welding rod.

FABRICATE "T-1" IN THE FIELD. You can weld "T-1" Steel *anywhere*. Since no pre- or post-heating is needed, you don't have to confine fabrication to locations where heat treating facilities are available. You can assemble heavy-duty equipment in the field, and you can repair it in the field—at great savings.

WHAT ABOUT JOINT EFFICIENCY? Weldments in "T-1" Steel develop the full yield strength of the steel — 90,000 psi.—when made with AWS E12015 low hydrogen coated electrodes *without* pre- or post-heating. As a result, weight reducing designs based on the greater strength of "T-1" Steel are completely safe and reliable.

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8'	12'
12'	12'
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24'	30'

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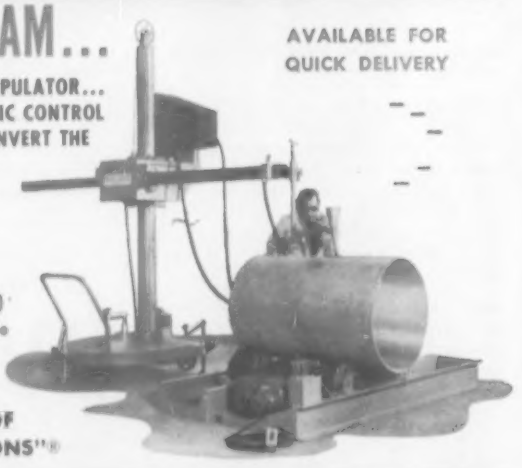

WRITE FOR BULLETINS RBM-1 and SAM-1 TODAY.

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A must

Dear Sir:

Just received the February issue of the WELDING ENGINEER which is a "must" in my reading and study.

Congratulations upon becoming publisher of such a splendid magazine. Will look forward to a finer and more complete publication, if that is possible.

Sincerely yours,
C. P. Sander
General Superintendent
Consolidated Western Steel Div.
Los Angeles

* * *

Mid-June "bible"

Dear Sir:

We use the WELDING ENGINEER Mid-June Welding Guide and Product Directory as our bible and for about everything that comes along. We are wondering whether you have extra sheets or copies of the "Portable Cable between Arc Welder and Power Source" chart as shown on page 11 of the 1954 directory issue.

Very truly yours,
S. Segal
General Welding Equipment Co.
St. Louis

—*They were sent.*

* * *

Encyclopedia

Dear Sir:

We thought you might be interested in the enclosed "Eutectic Welding News." *(Ed. note: It carried an article on* THE WELDING ENCYCLOPEDIA*).*

We are trying to encourage our district engineers to make greater use of THE WELDING ENCYCLOPEDIA. As you know, we consider this book an essential part of the equipment of all who are associated with the welding industry.

Very sincerely yours,
Arthur L. Phillips
Eutectic Welding Alloys Corp.
Flushing, N. Y.

* * *

"Design control"

Dear Sir:

The article "How design control can save you money" in your December issue was of exceptional interest to us here, because it touched a particularly troublesome problem.

If possible, we would appreciate one or two tear sheets of the article.

Sincerely yours,
C. E. Grimes
Design Engineer
Toro Mfg. Corp.
Minneapolis

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CADDY TEST INSTALLATION PROGRAM
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Here's why Norton flaring cup wheels are outstanding favorites for the widest range of weld grinding jobs:

Like all Norton portable grinding wheels they *hug that work*. Thanks to a Norton-developed process they have controlled uniformity and built-in balance to a degree never before possible. As a result, they keep more continuous contact with the work, with less vibration and bounce. This pays off in faster grinding, longer wheel life and less operator fatigue.

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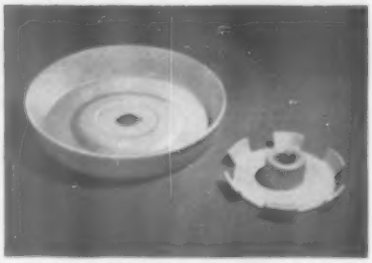
See Your Norton Distributor

for practical aid in selecting wheels that are exactly right for your needs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.



DOUBLE PROTECTION — The improved pronged-anchor, threaded steel bushing which is molded into the back of Norton cup wheels, shown with the revolving cup guard (which is popular when conventional guards can not be used or where there is a tendency to operate without guards). Both serve to hold wheel pieces together in case of accidental breakage. Extensive tests prove that this combination assures good operator protection.

W-1630

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Available as rough forgings, rough machined or finish machined . . . in a wide variety of alloys.

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Mid-States Viking Welders are available in three types to suit every industrial welding purpose:

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And in the well known Mid-States Welder group of lower amperage units there are sizes ideal for shop use—ranging from 7 to 300 amps capacity.

Whatever your arc welding problems may be, light or heavy duty, general or production work, there is a Mid-States to do the job the way you want it done. Write for literature and details today!

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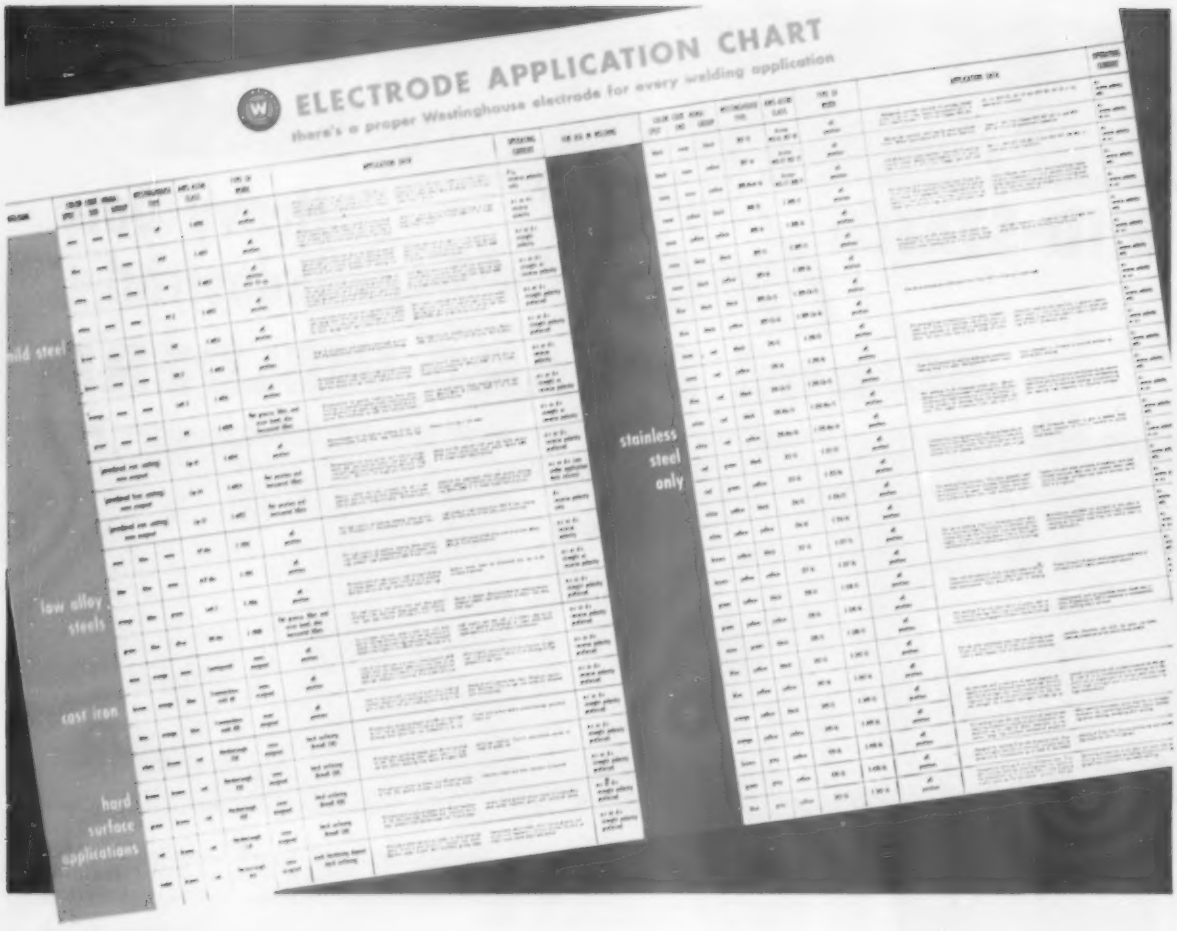

Now . . . you can get this entirely new welding electrode chart—*ABSOLUTELY FREE!*

In doubt as to which electrode to use? This 24 x 36-inch chart will help you decide. For example: Are you losing money because of slow speeds, high spatter loss or poor fit-up on a mild-steel job? You'll see the electrode for you is Westinghouse FP, class E-6012 using d-c straight polarity or a-c.

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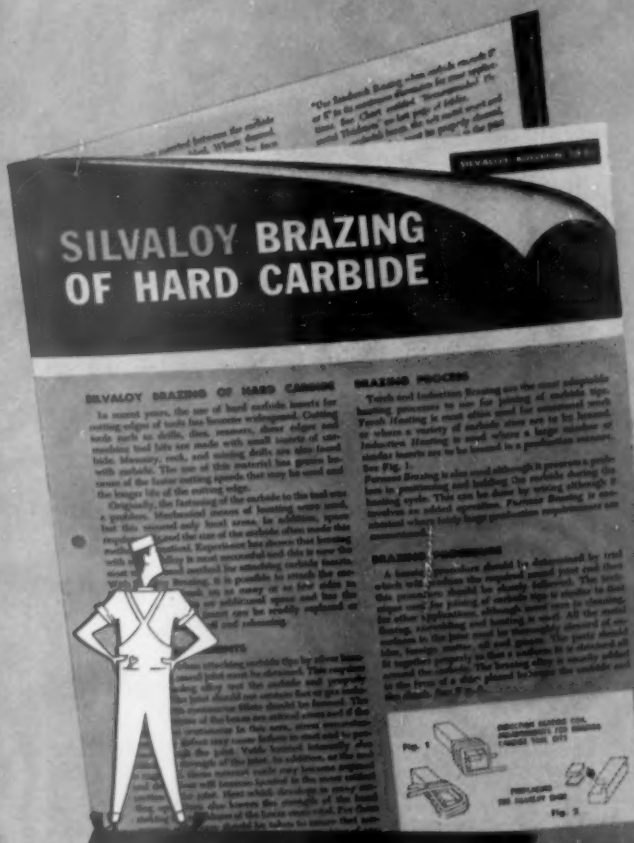
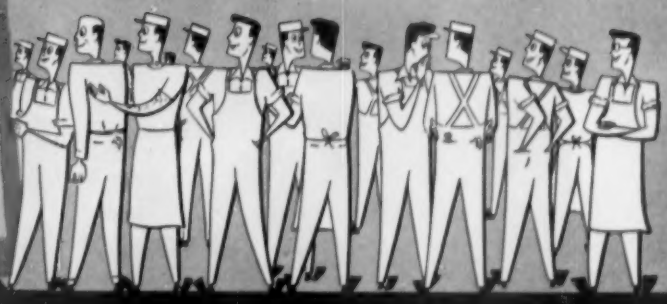


This newest Silvaloy Technical Bulletin is a complete review of up-to-date brazing procedure for joining hard carbide inserts to all types of cutting tools. The entire brazing procedure is described and fully illustrated in a step-by-step picture series.

Data is given on brazing processes, joint requirements, specifications of brazing alloys for hard carbide brazing, sandwich brazing with Plymetal and thermal stress in brazing carbide tips.

The new Silvaloy Bulletin 542 will be useful to production and design engineers, brazing technicians, etc. It has been prepared in a convenient file size and format for ready reference.

Be sure to send for your copy, without delay.



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ESTABLISHED 1916 **Welding Engineer** APRIL, 1955

Gertrude Hungerford Mackenzie

WELDING lost a loyal friend and staunch supporter when death came to Mrs. Gertrude Hungerford Mackenzie on March 11. Probably no woman did so much to promote and further the cause of welding as did Mrs. Mackenzie, yet not many in the welding world would be able to tell you much about her.

Few persons realized that the G. H. Mackenzie, publisher of WELDING ENGINEER from 1924 to 1945, was a woman, for Mrs. Mackenzie was never one to seek the limelight.

As recent editorials have pointed out, WELDING ENGINEER was founded by Louis Burton Mackenzie in 1916. At that time welding was little more than a maintenance process for even the most venturesome. But L. B. Mackenzie could visualize the importance of welding and its related processes in America's future and felt that it needed a voice in the industrial world.

Before he could realize his fullest dreams, Mr. Mackenzie died in 1924. At that time, his widow became president of The Welding Engineer Publishing Co. and publisher of WELDING ENGINEER.

Hers was a difficult job—that of promoting and pioneering an industry which had not yet come into its own—a job made even more difficult by the times. Within a few years there came the market crash, followed by chain reaction mergers of independent manufacturers of compressed gas until only a few nation-wide oxygen and acetylene producers remained. This change in the gas industry meant the loss of advertising and advertising revenue—the lifeblood of any successful publishing operation.

Soon "Mrs. Mac" was confronted with the problem of what to do with *The Acetylene Journal*, which had been serving the welding-gas industry since 1898. Since this companion publication of WELDING ENGINEER had lost most of its advertisers through those mergers, it was decided to combine the two publications for a bigger and better WELDING ENGINEER.

In 1932, when advertising in WELDING ENGINEER dropped to seven pages in one issue and few persons had $3 to pay for their subscriptions, friends were suggesting that "she get out while the getting was good." Instead "Mrs. Mac" saw to it that economies were effected, and WELDING ENGINEER went on promoting an industry which was still trying to find its way.

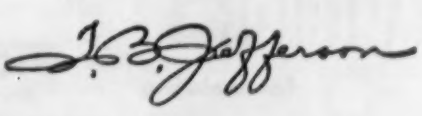
When the war years came along, the know-how which WELDING ENGINEER had been preaching and teaching was put to use in a big way. Welding came into its own as the metal-working industry began to use the many means of joining and severing metals afforded it through welding and related processes.

At the close of the war, "Mrs. Mac" decided she would retire from the publishing business. During her 21 years as publisher of WELDING ENGINEER she had seen her husband's dreams for his publication come true. "The voice of an industry" had led an infant idea through its formative years, helping it grow and to become an important part of every industry where metals might be used.

When the Chicago Section of the American Welding Society celebrated its 25th anniversary in 1945, it honored her for the role she and her husband had played in founding the Section. Shortly thereafter, Mrs. Mackenzie announced the sale of WELDING ENGINEER to McGraw-Hill Publishing Co., Inc., New York City.

Although retired from active business she never lost interest in the welding industry. Modest and having no desire for personal acclaim, she was proud of her husband's vision and foresight. She always said that her contribution to welding was "that of carrying out her husband's wishes."

Louis Burton and Gertrude Hungerford Mackenzie contributed much to the growth of welding, although untold thousands are unaware of their roles. As the last of the Mackenzies leaves this earth, the pioneering era in welding comes to an end.



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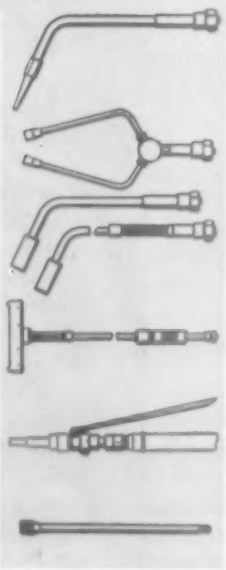
The versatility of VICTOR torches means you can buy exactly what you need for today's job, then add other nozzles, tips and attachments as required. Your equipment grows with your needs; stays custom-fit to your work. For example, here are a few of the 34 standard attachments for VICTOR 300 Series Torch Butts.

Start *right*. Buy the versatile VICTOR torch that grows with your job. See it at your VICTOR dealers *today* . . . or write NOW for Catalog 20.



Welding . . .
Here's one of 10 standard single-tip nozzles available for general welding and preheating.

Heating, Brazing . . .
You have your choice of 11 standard multiple-tip or multi-flame nozzles for preheating, brazing, silver soldering, etc.

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Save time and money with VICTOR attachments that fit your exact needs.

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Shuts off welding gas, keeps pilot light on, saves as much as 75% of total gas consumption.

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Let you handle hard-to-reach jobs, keep you cooler on hot ones.

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14

We've been asked by a good number of our readers for more job-shop articles. Here is an illustrated feature we think they will enjoy.—The Editors

1—DRESSING the casting. Broken edges of the casting should be filed until they are slightly beveled. Inner edges must be left intact for alignment

How to weld pot metal

BY HARRY AND KEITH KERWIN

WELDING the zinc alloy commonly known as pot metal, often found in door handles, carburetors, washing-machine gears and agitators, radiator grills and ornaments, etc., is supposedly a difficult and complex job, if indeed possible at all. The following article will describe an actual pot metal welding job in detail. It will try to illustrate all principles and techniques necessary to weld this metal easily and successfully.

Before welding is attempted, the type of metal must first be determined. Pot metal is sometimes called die casting or white metal. The term "white metal," however, is often used to include three different alloys which are very similar in appearance—zinc (or pot metal), aluminum, and magnesium.

Of these, magnesium is the lightest in weight, and pot metal is heaviest. Another method of identification is their different melting points. Magnesium and aluminum will melt near 1,080 to 1,195 F while pot metal will melt at about 725 F. Pot metal is far more common than the other two alloys, and about 75% of all die castings are made from it.

A final identification test requires playing a soft welding flame over the broken edge of the casting. If it is an aluminum alloy, the color will not change as it is heated, but the part will begin to swell slightly directly under the flame. If the casting is pot metal, it, too, will not change color, but the surface will begin to crack, and globules of metal will push up through the crack.

A word of warning at this point: remember that the welding flame may be as hot as 6,300 F while pot metal melts at about 725 F. A light brushing stroke of the welding flame, to be described later, is strongly recommended. If overheated, a section of the casting will suddenly collapse.

Carburetor Repair

The particular welding job to be covered here is repairing a cracked gasoline-engine carburetor. The first step is to disassemble the carburetor, removing all springs, jets, or rods which might be damaged by heat.

Next, carefully wipe any oil or grease off the broken parts. Surface oxide and dirt must now be filed off to about ⅛ in. back from the broken edges (photo 1). Extreme caution must be exercised lest you file or destroy the *inner* edges of the break. These edges are vitally important in realigning the broken parts.

The pieces are placed together using the original break as a guide. Important: the pieces must be adequately supported. After it has been heated, pot metal has no strength. An unsupported area may collapse.

In this case, the parts to be welded are supported by asbestos (which, in photo 2, is packed inside). Moisten the asbestos with water until it forms a thick paste. Then pack it around and under the broken parts until it provides adequate support for the welding. Because of the low melting point of pot metal, the wet asbestos will not draw off heat during welding nor impair the quality of the weld.

A ⅛-in. bronze welding rod should be cut to about 8 in. in length and one end flattened into a paddle shape

2—PREPARING for welding. Broken pieces of casting are placed together and supported with wet asbestos packed inside

3—SHAPING the paddle, which is used throughout the process. All rough edges should be smoothed with a file

4—TACKING and fusing the break, which should be tacked at four different points

about 5/16 in. wide and ¾ in. long (photo 3). File any sharp or rough edges until the paddle is smooth. This paddle may be used to remove scale and rust, clean a fracture prior to welding, assist in securing fusion between welding rod and pot metal, and to smooth the surface of the metal after welding. Warning: a steel welding rod should not be used as a paddle because an oxide will form on it when heated, and this will make it difficult to secure a clean, fused weld.

Tip Selection

Selection of the proper welding tip and flame must be considered carefully to avoid ruining the casting by overheating. Since pot metal does not change color while being heated, overheating is difficult to detect. For castings having a wall thickness of ¼ in. or less, a No. 72 drill size welding tip is used. Tip sizes will, of course, vary with the size of casting and type of joint to be welded. But in general use as small a tip as possible that will still secure the necessary heat.

Because of the great difference between heat of the welding flame and melting point of the casting, apply the flame in a way to keep it as cool as possible. It should be just hot enough to melt the joint, no more.

A good rule to follow: set oxygen and acetylene pressures on the regulators at 1 psi each. Turn on the acetylene gas in the torch, and light it. Turn on enough oxygen to reduce the long acetylene flame to about 4 in. If the casting is unusually thin, leave the flame predominantly yellow but not so much that it will deposit carbon. The flame must always remain long and flat. Do not add so much oxygen that it will pull the flame down to the white cone characteristic of the standard welding flame.

The welding rod must be basically of the same composition as the casting. Pure pot-metal welding rods of standard lengths and diameters are available from welding supply distributors.

You are now ready to weld the broken casting. Play the flame over the entire casting until all chill is removed. Apply the point of flame to the fracture itself; at the same time draw the bronze paddle lightly along the fracture under the flame. Continue this light scraping motion until the area of fracture grows hot enough to be plastic but not hot enough to melt and run. As soon as it is possible to move the metal with the paddle with ease, lift the point of the flame slightly, and use the edge of the flame to keep the metal at the correct heat.

Use the Paddle

Another word of caution: when the point of flame is lifted slightly, it may accidentally be directed against another part of the casting while you are concentrating on the welding. This could cause enough damage to ruin the casting, or at the least turn an otherwise simple repair job into a complex and difficult one.

Keep the joint just slightly plastic with a dipping in-and-out motion of the flame. Use the paddle to draw the the two bottom edges of the fracture together into a puddle. Be sure to secure complete fusion of the edges and penetration completely through the fracture. It may be necessary to scoop out a small amount of material in the joint to allow enough room for the weld. If any scale or dirt becomes visible in the puddle, scoop it out with the paddle.

Puddle the fracture together for about ¼ in. at a time at four evenly distributed points around the fracture (photo 4). These are tack welds, which will hold the two parts in alignment during welding.

After the four tack welds are made, begin welding between any two of these tack welds and go completely around the fracture, using the flame and paddle to fuse the bottom edges (photo 5). Again, complete fusion and good penetration must be obtained.

When you have completely fused the bottom edges of fracture, place the end of your welding rod in the puddle directly under the flame. This will cause the casting and rod to melt and flow together in a perfect union. Apply the welding rod with a slight dragging stroke along the fracture. Continue this process until the weld is completed. The weld should be built up slightly higher than the original casting, which will allow for smoothing down the weld flush with the casting's surface without leaving any undercuts along joint edges.

5—WELDING the casting. Break is brought to a plastic condition and rod added to puddle

6—SMOOTHING the weld. Deposit can be smoothed and flattened with careful use of paddle and welding flame

The paddle may now be used to remove most of the surplus weld deposit. Play the edge flame over the surface of the weld until the weld becomes just slightly plastic. Scrape or drag the surplus material off with the paddle (photo 6), taking care not to leave any low spots in the weld. If they do occur, add more welding rod to build up to desired height.

After it is allowed to cool, the carburetor may be reassembled and put back into service (photo 7). The weld should be virtually impossible to detect. As in most welding operations, the joint is now stronger than the parent metal.

Other Applications

Other succesful pot metal welding jobs include building up gear teeth on a washing-machine ringer assembly; building up an ear on a carburetor manifold without having to re-tap the threads; and filling in a large hole in a casting where the broken piece had been lost.

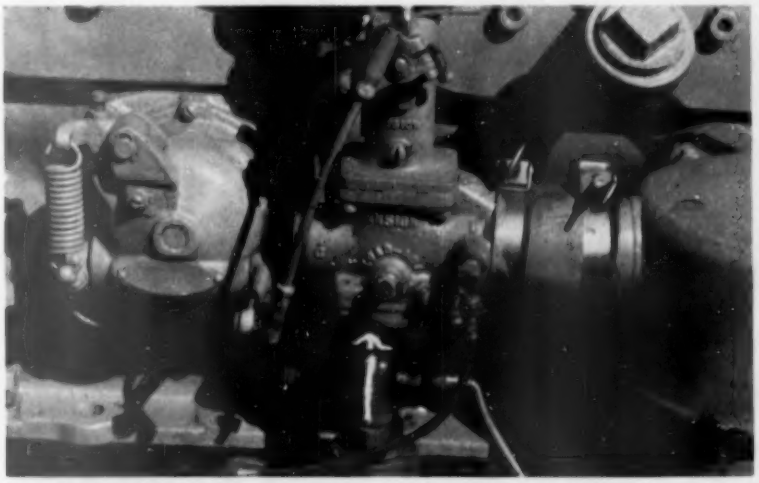
In building up the missing gear teeth, the base metal was prepared by cleaning, heating and scraping. A carbon stick from a small dry-cell battery was filed down to fit between the existing teeth to form a pattern for the missing tooth. Enough welding rod was added to build up the tooth. By using the flame and a bronze paddle, as well as a small file, the gear was rebuilt to as good as new.

In repairing the carburetor, broken squarely through the stud-bolt hole, all parts vulnerable to heat were first removed. The stud bolt, used to fasten the carburetor to the engine manifold, was placed in its correct position in the carburetor manifold. With the casting prepared as previously described, the weld metal was deposited on top of the bolt, fusing it to the manifold on all sides. When the weld deposit was high enough to insure correct size after filing, the casting was allowed to cool.

The stud bolt then was screwed slowly out of the casting, leaving a perfect thread. The bolt was not harmed because of the great difference in melting points of its iron composition and the pot metal casting. After the surface of the casting was filed smooth, the carburetor was reassembled and placed in service.

In filling a large hole in a casting where the piece had been lost, a metal plate was cut and placed up under and against the hole to act as a back-up plate. Welding rod was deposited over this until the entire hole had been filled. Care was taken to make sure the deposited metal fused completely with the original casting.

In general, if your pot metal casting is carefully prepared, properly aligned, and supported to prevent collapse or distortion, and if you follow the welding procedures previously outlined, you will encounter little difficulty in welding any pot metal article. This is true even for the person who has only a slight skill in ordinary oxyacetylene welding.



7—PLACING into use. Here is the welded casting—smoothed, flattened and painted

DERRICK back in service after bent members were straightened. Its capacity is about 35 tons, and the boom is 90 ft long

WALE at extreme left has been straightened; next one has only small bend at far end; two on right are shown as bent

We promised you more examples of stress control by the author of last year's most controversial article. Here he tells how you can save money if you

Keep your oxyacetylene torch busy

BY JOSEPH HOLT

ARE you getting the most—100% usefulness—from your oxyacetylene torch, or is it idle part of the time? At present, many dollars are being wasted in buying and fabricating new steel to replace damaged members or entire structures. These dollars could be saved or better spent elsewhere if more torches were put to work on stress control.

AUTHOR applies torch heat to one of the derrick's twisted "I" beams. The job described on these pages was one of the most difficult the author has ever undertaken

(In his article on "Grass roots of stress control," published by WELDING ENGINEER in February, 1954, Mr. Holt wrote, "Expansion and contraction of metals resulting from a change of temperature are commonly understood. Very few, however, realize the enormity of such residual stresses. Eventually, something must upset, stretch, distort, move or break to satisfy the stresses . . . created as a result of temperature changes. . . . Straightening is simply a matter of the proper application of localized heat along an edge that needs to be shortened. The locally applied heat causes expansion, yielding and upsetting, after which straightening is accomplished by contraction that occurs during cooling. Judicious hammering helps the process along."—Ed. note)

Here are data and pictures of what an oxyacetylene torch did in a seven-month period to assist a contractor on a $3,500,000 bridge spanning the Chehalis River at Aberdeen, Wash.

Cofferdam Wales

The 24-in. I beam wales of a cofferdam were bent in process of removing them. These wales, consisting of 10 pieces 60 ft long, were needed immediately for construction of another cofferdam of the same size. Straightening them on the job, by the use of the torch, saved more than two weeks in time and, in addition, saved possible cost of new material which would have been needed to replace those wales most severely bent.

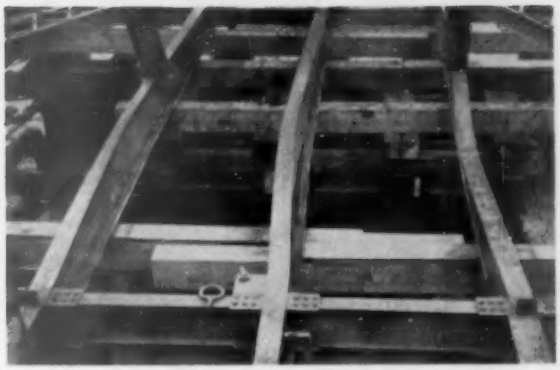
The top right photo gives some idea of what those wales looked like before and after treatment.

The next job was a mammoth "stiff-leg" derrick. It was more than 36 ft wide by 60 ft long. Five 18-in. I beams formed the runners. The cross-members were also 18-in. I beams, with a heavy H beam across the front. This H beam was a stiffener and base for the 45-ft "stiff-leg" and "bull wheel." It was 16 in. high by 16 in. wide by 36 ft long.

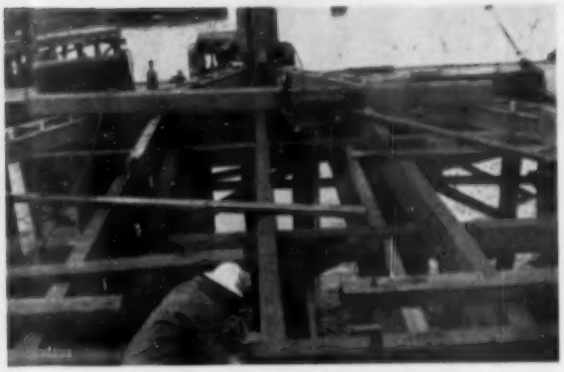
The boom was 90 ft long with a 30-ft jib boom.

This all-electric derrick had a capacity of approximately 35 tons. An extremely high tide had loosened many large "deadheads" (water-soaked logs) in the river above. The submerged logs and the outgoing tide, together with other damaging weather conditions, dumped the derrick into the river. The rear end went down first so that it struck on this end and somewhat cornerwise.

Before . . . *. . . After*



THESE "I" beams took the course of least resistance



SAME beams shown after they were flame-straightened

MORE "I" beams before introduction to the torch

SHOWN after straightening, beams are 60 ft long

Many Members Bent

Here's what happened to the vee-shaped front half of the derrick: cross-members were bent upwards about 4 in. on each side of center as well as sideways; so was the heavy H beam; all five of the 18-in. runners were bent upwards about 7 in.

The weight of the 90-ft boom and 30-ft jib boom, together with the "stiff-leg" of 45 ft, was too much for the I beam runners when the derrick struck bottom. As a result, the I beams took the course of least resistance and twisted sideways, as shown in top left photo on this page. Photo next to it shows these I beams after an introduction to the oxyacetylene torch.

The torch also corrected the deformity of all three sections of the "bull wheel" (its circumference was an 8-in. H beam in 3 sections and rolled to a 16 ft circle).

Torch heat, properly applied, realigned practically all the members of this derrick to their original places and shapes without removal from the structure. The "bull wheel" and its braces, however, had to be removed.

MEMBER'S bend is quite apparent

HERE it is after torch treatment

The torch method provided a great saving in time and money. And on this straightening project, time was all-important.

The saving to MacRae Bros. Contractors was at least three weeks in time on the bridge and several thousand dollars in money.

Torch time was 34 days.

Whether you're a contractor, torch operator or equipment salesman, it would pay you to investigate the possibilities of straightening through use of properly applied torch heat.

Is cast iron really the problem child it is made out to be? Not according to the author who, in a two-part article, will give you his reasons for preferring the . . .

TYPICAL foundry charcoal pre- and postheating bed. But where such facilities do not exist, it is often necessary to use welding techniques which will not require preheat and subsequent postheating

Low-heat method of

BY ARTHUR L. PHILLIPS
Eutectic Welding Alloys Corp.

CAST iron is a popular fabrication metal because it is relatively inexpensive; it is easily cast to a desired form and can be machined readily.

This last-named property is sometimes considered the most important of all. Machine time is expensive, and cost of the finished product is determined by the amount of machining required. This sometimes amounts to a sum greater than the cost of casting a part. Machinability, therefore, is likely to be a vital factor wherever cast iron is involved. And anything which reduces machinability is to be avoided where possible.

The widespread use of cast iron has presented problems to the weldor. When breakage occurs, cracks appear, or surface defects are exposed, repairs have to be made. Many weldors hesitate to work on cast iron because they know from experience that results may not be satisfactory. This has led to the erroneous belief that cast iron is unweldable and that results are unpredictable. A satisfactory weld can be produced one day and yet, upon an apparently similar piece of metal with a similar joining alloy, the weld fails the next time an attempt is made.

This paradox has given rise to the impression that cast-iron welding should be avoided. When necessity dictates repair, the operation is approached with reluctance.

Cast iron does present problems in joining operations, but when the nature of the metal is understood and its characteristics studied, procedures which will eliminate many of these problems can be adopted.

FORMS OF CAST IRON

The carbon in cast iron is the element that causes most of the welding problems. If present in the form of iron carbides (cementite), the metal will be hard and brittle. On the other hand, if it is present in the form of graphite flakes (free carbon), it is soft and machinable.

White Cast Iron

Carbon is present in white cast iron in the form of combined carbon. The metal is hard and brittle. It is easily recognized, when broken, by the appearance of the break. The surfaces appear silvery white, and there is little graphite present. If you rub your finger over the surface, it comes away comparatively clean, indicating the carbon is in a cementite form.

Grey Cast Iron

The most common type of cast iron encountered is grey cast iron, so-called because a fracture is grey in appearance. This is caused by the free carbon or graphite. When the finger is rubbed over the surface, it comes away smudged with graphite.

In its molten state, practically all the carbon is in solution. When the material is cooled rapidly, most of the carbon remains in this form, and the metal produced is white cast iron. When cast iron is cooled slowly, nearly all the carbon will pass out of solution and will become flakes of graphite or free carbon.

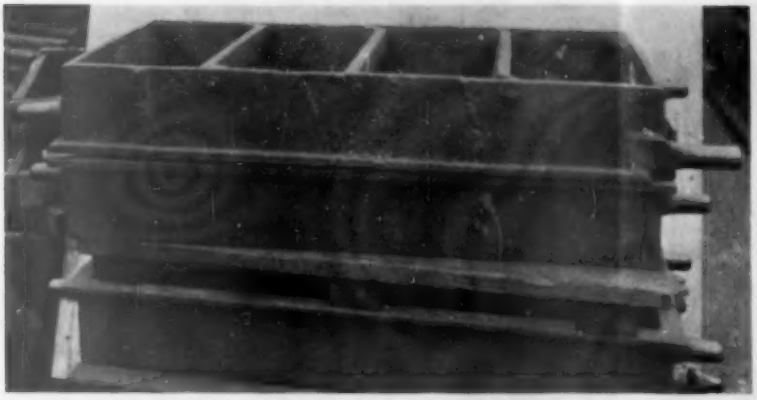
This has the effect of weakening the metal because graphite flakes separate the particles of iron from each other. However, iron and graphite are relatively soft, and this form (grey cast iron) is fully machinable.

Malleable Cast Iron

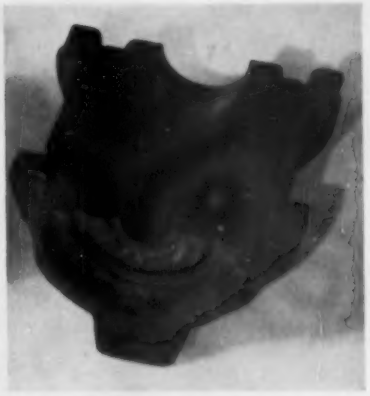
When white cast iron is annealed at the correct temperature for a given period of time, it becomes malleable cast iron. The carbon undergoes a change. The metal is fully machinable and possesses greater strength and ductility.

White cast iron contains carbon in combined form. This iron carbide, or cementite, is a hard brittle substance which responds to the annealing process. It changes its form to graphite, but the process is so slow that it remains in small round masses instead of flakes. This does not break up the structure of the iron and does not separate the particles as would be the effect if the carbon were in the form of flakes.

Free carbon, or graphite flakes, does not change its form during annealing. If present in a casting, the



CAST-iron foundry flasks and centers have to withstand a great deal of rough usage. These were repaired with use of oxyacetylene torch and a flux-coated rod



GLASS molds of cast iron became badly pitted after extended operations

welding cast iron

metal cannot be annealed to form malleable cast iron.

This is a reason for difficulty in welding malleable cast iron by the fusion-welding process. When the metal is heated beyond its critical heat, the carbon goes into solution. Unless a long annealing treatment is given, the welds will be hard and brittle because they will pick up carbon from the base metal. Annealing takes from three to six days in a furnace maintained at approximately 1,400 F. This is the critical temperature beyond which the carbon will go into solution.

But it is possible to join malleable cast iron below this heat. In a low-heat input method of joining, the amount of carbon that goes into solution is negligible, and the metal retains its strength, ductility and machinability characteristics.

CHARACTERISTICS

Two properties in all forms of cast iron work against the weldor. One is low thermal conductivity, the other its high coefficient of expansion. Cast iron does not conduct heat readily. One part of a casting may be cold, the other red hot. Yet the metal expands readily under influence of heat.

(These two properties alone could be responsible for the widespread belief that cast iron is a problem metal. Anything imperfectly understood can be a problem.)

Cast iron expands slowly until it reaches a red heat, then the expansion is accelerated. If an iron bar is held rigidly at the top and bottom it will expand longitudinally when heated. The increased length of the metal, caused by heat expansion, has to be accommodated. The bar will not bend, and if there is no room for expansion, the bar will break.

Stresses set up by uneven expansion of cast iron cause many weld failures. When part of a rigid cast iron structure is heated, this section tries to expand. It exerts pressure upon the unheated section and sets up stresses. When these stresses exceed the tensile strength of the casting, failure is inevitable.

Combating Stresses

Knowing that these characteristics exist, the weldor can take precautions. When a casting is preheated to approximately 800 F, the entire part has expanded uniformly. Local heating can then be continued without the same danger of cracks. Expansion of a single section is absorbed without setting up undue stresses elsewhere. This method has obvious disadvantages.

Preheating facilities are not available for large castings, except in the bigger shops. When furnaces are available, preheating is no problem, but it is not profitable to install furnaces unless there is sufficient volume of work to justify such installation and operating costs.

In an emergency, oxyacetylene torches can be used to preheat large castings. Sometimes three or more torches are needed to keep a large casting at desired temperature. This can be time-consuming, expensive and not too practical.

Small parts do not present these problems because preheating is simple.

Preheating, however, will not prevent the carbon going into solution if the casting is heated beyond its critical range. Where the metal is melted, the carbon will remain as cementite, a hard unmachinable iron carbide, unless a controlled rate of cooling is adopted.

When the metal can be joined below its critical heat, many problems disappear. Selection of suitabe alloying elements has made it possible to produce materials with a lower melting point than the base metal. Selected for their strength and affinity for cast iron, they surface-alloy with the parent metal and give bond strengths comparable to fusion welded joints, yet do not alter structure of cast iron.

With Torch and Arc

Even if application heat exceeds the critical temperature of cast iron, the relatively low heat and its short duration prevents an appreciable amount of carbon from going into solution.

When using a torch, the base metal

EMERGENCY repair on differential housing of tractor was completed at between 400 and 500 F. Alloy was applied after crack was cleaned, veed and tinned

is brought to its bonding temperature —the heat to which it must be raised to permit the molten filler metal to surface-alloy with it. The joint is not a mechanical one. There is diffusion between base metal and filler metal. A new alloy is formed at the interface which possesses properties of both metals.

The same process has been applied to arc welding. By careful manipulation of the arc and by following recommended techniques, it is possible to weld cast iron with fully machinable weldments without preheat. The controlled heat prevents the formation of iron carbides.

Another method of controlling heat input is to use skip-welding. Short stringer beads are applied, spaced as far from each other as practical. Each pass should be peened to relieve residual stresses and to expand deposited metal.

When deposits are applied, they are in their expanded state. They contract on cooling, causing the deposit to shrink away from the parent metal. If the stress is greater than the strength of the bond, a crack will develop where filler metal joins base metal. When the bond holds firmly, the deposit itself will crack. Peening relieves these stresses. Deposits are expanded, and the danger of cracking is greatly minimized. Peening has the effect of cooling the deposits.

The weld area should remain at a black heat throughout the welding operation. If color shows at any time, stop welding and wait for the part to cool. The casting itself should remain at a comfortable hand heat during welding.

This is easy to accomplish if recommended procedures are followed. If the weldment is comparatively long, the first deposits will be cool by the time the last pass is made. This permits the work to proceed at a good pace.

Wait for Cooling

When the weldment is short in length, it may be necessary to wait until deposits have cooled before applying further deposits. A good way to prevent loss of time: work on several parts at the same time, if practical. When several cast iron parts are assembled for welding, the first deposits are applied in rotation to each part. Deposits are peened, and the next deposits are applied to the parts using the skip-welding technique.

In this way, the work moves right along, and each casting is kept at a comfortable hand heat. Hard spots and non-machinable deposits will be avoided if the absorbed heat is kept to this minimum.

A single welding alloy could never answer all your demands and solve all problems encountered in joining cast iron. The type of cast iron must be studied, immediate needs must be evaluated and the end use taken into consideration. When a part is operating at room temperature, the coefficient of expansion of the filler metal is relatively unimportant. A difference in rates of expansion between filler metal and base metal will not affect the joint. This permits a certain amount of latitude in choosing an alloy.

When a part operates at high heats, it is essential that the filler metal expand and contract at the same rate as the parent metal. If the coefficient of expansion is not the same, the filler metal will pull away from the base metal, and weld failure will result.

APPLICATIONS

Cast iron foundry flasks and centers have to withstand a great deal of rough usage. Breakages are frequent, and it is no uncommon sight to see many of these parts stacked in corners awaiting repair.

The repair of such parts presents no particular problem if the correct techniques are used and the metal is not heated beyond its critical range. A flux-coated rod for gas welding was used for the repair depicted. The defective area was thoroughly cleaned, veed and broadly heated with the neutral flame of an oxyacetylene torch.

The tip of the flux-coated alloy was inserted into the flame to allow a small amount of flux to melt off onto the weld area. This was to act as a temperature guide. The flux was temperature indicating, and when heat of the parent metal caused it to melt and flow, it would be a signal that the base metal had reached the correct bonding temperature.

Bonding temperature of the alloy was approximately 1,400 F, about 900F below the melting point of cast iron. When the weld area reached this temperature, the torch was held at a low angle with the cone of the flame directed upon the filler metal. Sufficient heat was thus maintained to keep the weld area at a bonding temperature but not to raise it beyond this point.

Beads were applied and flowed ahead. When they had alloyed to the surface, more filler metal was applied by dipping the rod into the molten puddle, the heat of which was sufficient to melt more alloy. Each deposit was flowed ahead before more was applied. The liquid flux had high fluidity and flowed ahead of the alloy, keeping the weld area free from oxides and acting as a protective

coating. At no time did the metal show excessive heat color.

When finished, the welds were examined for pinholes and porosity, but the weldments were sound, dense and free from visible defects.

Glass Molds

An entirely different problem was encountered in the repair of grey cast-iron glass molds. High strength deposits with good bonding properties were essential, of course, and high machinability was necessary. The weld had to be entirely free from porosity and pinholes because any irregularity would show up in the finished part.

The molds had been in service for some time, and the constant heating and reheating had produced a surface other than the original cast iron one. High molding temperatures had burned out the graphite from the mold's surface. Oxides had formed, and some of the silicon from the glass had combined with the iron.

Here was a prime example of what has been stated previously; the coefficient of expansion of the filler metal must be similar to that of the base metal or the continued heating and cooling will cause weld failure.

Another type of flux-coated rod, which possesses the same coefficient of expansion as cast iron, was selected.

The molds were badly pitted so the alloy was applied in the manner already described, but single beads were deposited and flowed into and around the defective areas. This reduced after-machining to a minimum because it was possible to fill in shallow irregularities without leaving a quantity of excess metal.

Cylinder Block

Still another problem is encountered in the automobile industry. A crack in a cylinder block can be repaired with conventional materials and methods if the engine is removed from the vehicle. It may take between 50 and 70 man-hours for dismantling and reassembling when preheating is necessary. All parts which would be adversely affected by the heat have to be removed. This difficulty can be overcome by use of a low-heat input welding process.

Recommended for this kind of repair is a solder-type alloy which will bond to cast iron at between 400 and 500 F—far below the critical temperature of the metal. It should be used on parts which are not subject to high operating temperatures. It must be applied with a definite technique, however, if maximum results are to be obtained.

The Procedure

If a crack develops in a cylinder block, thoroughly clean and vee the area. Drill a small hole at each end of the crack. This will prevent the crack from spreading. Run the engine until the water in the jacket reaches approximately 180 F. Drain the water from the block and run the engine for a few seconds to dry out the block. The block will have reached a temperature of 150-180 F. This will permit the use of a small oxyacetylene torch tip.

Use a slightly excess acetylene flame and heat the beginning of the veed area for about 2 in. of its length. Heat a 3/16-in. rod in the flame and dip it into a temperature-indicating flux that will remove oxides and promote bonding. The flux will adhere to the heated rod and can be transferred to the joint area. When the flux liquefies, bonding temperature has been reached. Rub the tip of the rod against the heated metal, and tin the surface for a distance of about 2 in. Heat the next section, tin it and continue, step by step, until the entire vee is tinned.

Start at the beginning again, dip the rod into the flux and melt the alloy onto the tinned area. Hold the torch parallel to the casting. There will be sufficient heat in the casting so all that is necessary is to melt the alloy. If the alloy melts when the rod is in contact with the base metal, the casting is *too* hot, and the joint will lack desired strength.

This procedure has been devised to prevent overheating the base metal. The vee could be tinned and filled in one operation, but the flame would remain upon an area for a greater period of time. And the build-up of heat would eventually break the bond to the cast iron. Oxides would form ahead, and these would have to be removed or the joint would lack strength.

When cast iron has to be protected from severe abrasive wear, a hard, wear-resisting overlay is required. Use a rod developed to give such wear resistance. A preheat of approximately 800 F is necessary. Another type of temperature-indicating flux is applied to the metal to act as a heat guide. When it flows out, the alloy is applied. Beads can be flowed by heat of the torch so thin layers may be applied or contours built up to desired dimensions. The critical temperature is exceeded, but machinability is not expected in a hard overlay.

"The electric arc method has always been associated with fusion welding, but developments in welding technology have made it possible to apply deposits without melting the base metal."

The above quote is from the second part of this article, in which Mr. Phillips will discuss the joining of cast iron by the arc-welding process.

Electrical construction simplified by stud welding

Six new warehouses, each measuring 200 ft by 1,000 ft, recently completed at the U. S. Army's Memphis, Tenn., General Depot, called for a major fastening operation in hanging 140,000 ft of electric conduit, 4,020 outlet and switch boxes and 3,726 lighting fixtures from structural steel ceiling and wall members. A total of 519,000 ft of wire was installed. This included 360,000 ft of No. 12 wire.

The contractor, Shelby Electric Co., Memphis, chose stud welding as the fastening method.

In this process, the stud welder places the threaded end of the stud in the chuck of an arc-welding gun. Setting the exposed precision-centered solid flux of the stud at the point of welding, he pulls the gun "trigger" and the stud is welded automatically. Duration of the welding arc is regulated by the integral stud-welding control unit. On overhead construction work without a production jig, one man may weld studs at speeds up to six a minute.

The advantages of stud welding proved threefold in the Depot job: (1) A small crew of men was above to lay out and install studs with minimum supervision; (2) a saving of $8,500 in construction time was realized from the speed of stud welding; and (3) the assembly of conduit and outlet boxes was simplified by welded studs being in precise position to receive the equipment.

—KSM Products, Inc.

Maintenance at Kitimat-Kemano

1—BODY patching was big maintenance job on these 5-cu-yd dump trucks

In the wilds of British Columbia, maintenance welding kept all types of heavy-construction equipment in operation on the $550,000,000 project of Aluminum Co. of Canada. When finally completed, the project will include a good-sized city and a large aluminum smelter.

BY TED JEFFERSON

(Basic information and photos courtesy I. MacFadden, Canadian Liquid Air Co., Ltd. Montreal)

WHEN a construction camp's nearest source of supply for repair parts is 450 miles by steamer or chartered plane, welding becomes extremely important. This is especially true when the "nearest source" does not always stock the proper parts. Morrison-Knudsen of Canada, one of the contractors on Aluminum Co. of Canada's fabulous Kitimat-Kemano project has known this for years. The fact was forcefully brought home daily on this construction project in a remote part of British Columbia.

In a raw, rugged, unpopulated region, man has developed one of the great engineering marvels of North America. Every type of engineering has been put to work in this relatively inaccessible spot. The job started with carving roads from sides of mountains while tunnels were being punched through them. Before the entire project is finished, there will be built huge power and industrial plants and a modern city with a potential population of some 50,000 persons.

Two-Fold Role

The first phase — the aluminum smelter—has already been completed, and aluminum ingot is now being produced. Present annual capacity is 91,500 tons, but a proposed expansion to 330,000 tons has been announced.

Welding's role has been two-fold. Without welding, it would have been difficult, if not impossible, to accomplish many of the (1) maintenance and (2) fabricating operations necessary to keep the job going. Maintenance welding's task of keeping the $20,000,000 worth of equipment required for the project in operation will be discussed here. The major portion of welding's role in fabrication will be discussed in a later article.

While every type of construction equipment imaginable was in use on the project, it was the earth- and rock-moving equipment that really took the beatings. A visit to the project's maintenance shops told the story.

These shops were conveniently located throughout the project site to provide quick service. All were equipped for arc- and gas-welding as well as flame-cutting and flame-treating. Since the problem of combating or reducing wear was ever present, extensive use was made of hardfacing.

A typical day's activity in the lives of the maintenance weldors was also revealed by a visit to any maintenance shop. Of course, some items needing repair were too large to bring into the shop, so the weldor went to the job. An example: repair-

2—UNUSUAL pattern of hardfacing deposit meant longer life for mucking-machine buckets

3—BOOM on mucking machines also needed hardfacing and patching

ing the dump bodies of the 5-yd dump trucks shown in photo 1.

Flame-Cutting

These big dump trucks were used to haul muck and rock from the 10-mile tunnel system on the project. The bodies soon became beaten and battered and, without repair patching, would have deteriorated rapidly. This is where flame-cutting came into play.

Body repairs were made by flame-cutting out those pieces that were badly deformed or that ruptured under the impact of falling rock. Usually, the plate was cut alongside the vertical ribs and at sufficient distances horizontally to remove the major defects. The horizontal edges of the body plate were then flame-heated and straightened so that a patch could be welded in place.

A patch plate, usually of heavier gage than the original dump body stock, was then flame-cut to fit the opening. After being checked to insure a good fit, it was welded in place with an AWS E-6016 type electrode. The low-hydrogen electrode was used to avoid any trouble that might have arisen from welding steels of unknown analysis.

Hardfacing

If there was a problem of abrasive wear as well as impact wear on these dump bodies, generous applications of an austenitic (work-hardening) type of hardfacing were made.

Where hardfacing really did its stuff was on the mucking-machine buckets (photo 2) used in loading mine cars. These were subjected to abrasive wear when they scraped over sharp rocks on tunnel floors. One of the secrets of successful maintenance hardfacing: make the hard metal deposit so effective that it will impart longer life to the part it is to protect. The unusual pattern of the deposit on the bucket's side in photo 2 is an example of an effective application.

Note that the deposit of hard metal on the bucket bottom is crosswise rather than lengthwise—this prevents scouring action as the bucket slides over the tunnel floor. The teeth, bucket lip and the inside were also protected by hardfacing. All arc-welded deposits were made with a work-hardening type of electrode. Such a deposit gets harder as it is subjected to abuse under impact.

Preventive Maintenance

The mucking-machine boom needed its share of maintenance welding, too (photo 3). Here again flame-cutting was used to remove badly bent plates. Continual contact with granite walls of the tunnels subjected these booms to both abrasive and impact wear.

While most of the maintenance welding was undertaken to repair actual wear or damage, there was also a preventive-maintenance program. Parts known to be subject to damage or wear were often reinforced beforehand rather than await failure and then make repairs. Mucking-machine booms were among those given preventive-maintenance treatment.

Build-up of Stainless

Stainless steel was used for build-up of front idlers on crawler-type tractors (photo 4). It was chosen because it has good wearing qualities and a tendency to toughen under service conditions. At the same time, the deposit does not become brittle nor tend to spall, as might be the case were a harder material deposited. The stainless deposit is somewhat softer than the deposit on the track rails, which makes for a good wearing combination.

(It has been found in hardfacing applications that much better service life is obtained if parts which come in contact with each other have different hardness characteristics. Thus, parts that are wearing against one another should not have the same type of deposit—one should be softer than the other. In this way, wear on both will be slower.)

The going for crawler tractors was so rough at Kitimat-Kemano that the track roller guards were welded in place. Normally, these guards are bolted on, but too many bolts broke off.

Loader buckets used on crawler tractors also came in for heavy main-

4—STAINLESS steel deposited by arc process retarded wear on crawler tractor front idlers

tenance. This equipment was used to load rock, gravel and other materials into dump trucks. While frequently called upon to do the same type of work expected of a power shovel, the dipper is much lighter in construction. This is especially true of the lip. Hence the lip often needed straightening—a job assigned to the oxyacetylene heating torch (photo 5). While some operators had achieved sufficient skill to do a straightening job by spot heating (employing expansion and contraction), a sledge hammer generally was used to speed the task.

Hardfacing was also used on the loader buckets—most frequently on bucket teeth, which were built up regularly with manganese steel to obtain the work-hardening characteristics of this material. On hardfacing applications where a mass of metal was involved, build-up was by the arc-welding process.

(At Kitimat-Kemano, as on all jobs where maintenance welding is carried on, it was found that "repaired" equipment gave better service life than did the original equipment. There was a reason for this: those parts which were subjected to the greatest wear were easily spotted and reinforced. Since welding is playing such an important role in construction equipment—not only in its maintenance but in its actual fabrication as well—such equipment manufacturers are now studying on-the-job maintenance activities with the though of improving their "original" products.)

Not All Repair

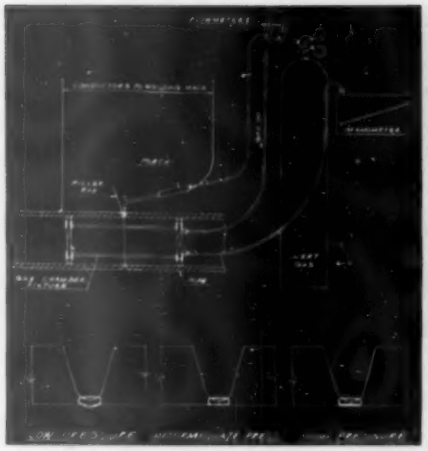
Not all welding in the maintenance shops was of a repair nature. Photo 6 depicts the welding of a step on a concrete bucket. These big buckets, holding several cubic yards of concrete, were lifted by cranes and tramways in order to pour concrete in any part of the powerhouse. The step was welded so the operator would have some place to stand. He had to ride the bucket to see that its contents were dumped in the proper spot.

As in the case of any isolated construction activity, these are just a few of the jobs that came into the welding shop. The maintenance weldor on such a project must be an all-around, all-position weldor, ready to tackle any job that comes along. He may not always know just how to handle the job as it comes in the front door, but you can bet that he has learned how before it goes out the back door.

And this is true whether it be the bull cook's aluminum pot or a tricky hardened-steel tool.

5—LOADER bucket lips were straightened with oxyacetylene flame. Hammer helped speed the job

6—NOT all welding was maintenance. Weldor fabricates step on concrete bucket



1—TOP: details of portable gas-chamber fixture. Bottom: shape of interior of weld surface is controlled by varying pressure

2—ROOT bead is laid while pipe interior is under controlled inert-gas pressure in the gas-chamber fixture. This is first critical step in forming the weld. Successive beads are applied by manual arc process

3—FINAL reinforcing beads complete welding of the joint, designed for 1,100 F and 2,350-psi steam service

4—POST-heat treatment of weld is carefully controlled by attaching thermocouples to measure metal temperature

5—WELDED joint is wrapped with asbestos paper over which coils of copper tubing are placed prior to stress relieving

New pipe-welding process

FORMED structures of such hard-to-weld (but industrially important) materials as titanium the "super alloys," aluminum, or air-hardening steels can now be fabricated readily with complete-penetration and controlled-contour welds.

A major cause of failure in welded joints—root bead cracking—is said to be eliminated by a new process of welding high-strength metals. Precise control over the application of the root bead—the all-important initial bond between welded joints—is integral to the process itself, rather than being dependent upon the skill of the operator.

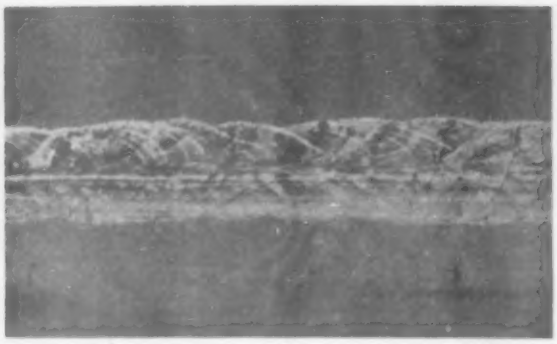
Attaining full penetration in single vee butt welds, from one side without backing rings, has depended upon outstanding operator skill . . . a skill which cannot be maintained at high levels of performance without excessive physical strain.

Through precise control of technique, physical dimension and internal gas-shielding pressure, the new method produces root beads of assured full penetration and controlled internal contour. It also results in a uniform rootbead surface free of undercutting and a high degree of root bead reinforcement—without backing rings and only average operator proficiency—according to The M. W. Kellogg Co., Jersey City, N. J., a subsidiary of Pullman Inc., developer of the process.

Inner and outer inert-gas shielded arc welding is used in applying the initial or root bead to the joint being made (see diagram). By accurately controlling gas pressure inside a pipe or weldment, the weld is deposited with a uniform internal contour. By varying gas pressure, the inner surface of the bead can be made slightly convex, flush, or even concave. The concave condition would rarely be desired since it results in reduced

(Continued on page 41)

1—FRONT appearance of joint in welded titanium sheet



2—BACK of same joint. Weld-metal surface was bright

Fusion welding titanium

Methods of welding titanium—the lightweight metal—come in for their share of discussion. Here is an account of how one West Coast firm's experiments brought surprisingly good results.

BY ALAN V. LEVY
and ROBERT WICKHAM*

IN order to minimize the amount of weld-bead grinding required to produce certain critical parts for turbojet and ramjet engines, Marquardt Aircraft Co., Van Nuys, Calif., has investigated the possibility of hand welding commercially pure titanium sheet by the Tig (tungsten inert-gas) process, but without using filler metal. Results were surprisingly good.

Problems connected with grinding titanium weld beads primarily centered around severe grinding-wheel wear associated with operation and time necessary to remove a given volume of metal. In addition, a tendency to overheat the metal at the joint resulted in localized embrittlement. The procedure required to remove embrittled areas and rework parts proved to be uneconomical and resulted in scrapping of parts in a few severe cases. Obviously, elimination of the grinding operation could greatly improve quality of titanium components.

*Mr. Levy is engineer in charge of materials and processes, and Mr. Wickham is welding engineer, for Marquardt Aircraft Co., Van Nuys, Calif.

Same Conditions

Initial experiments used the same general hand welding conditions as previously used for welding with addition of filler rod. These conditions were:

(1) Back-up bar—copper with ¼ in. by ⅛ in. "U" groove; ⅛-in.-diameter holes spaced at 6-in. intervals along root of groove for introduction of back-up gas.

(2) Hold-down bars—2.5 in. by ½ in. mild steel bars chamfered at 45-deg angle on weld side to ⅛ in. thick.

(3) Welding machine—200-amp. d-c welder with a Tig torch, No. 8 ceramic cup and 1/16-in., 2% thoriated-tungsten electrode. Straight polarity was used.

(4) Cleaning—solvent wipe of as-received material.

(5) Machine settings—current, 70 amp; voltage, 25 volts.

(6) Argon gas flow—top of weld, 20 cfh.

(7) Manual welding speed—approximately 3 ipm.

Material welded was 0.040 in. commercially-pure titanium in annealed and pickled condition.

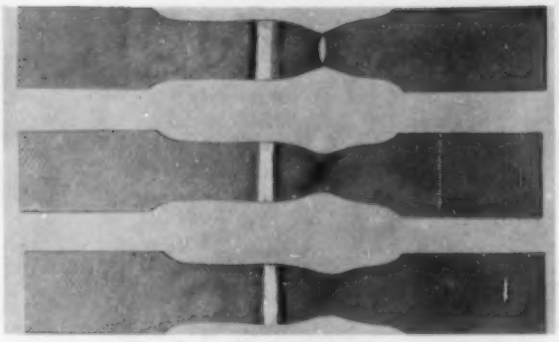
Test results showed that major gains in desirable weld configuration and ductility were made by welding without rod. Refinement of welding conditions further improved joint characteristics. But the first series of flush welds exhibited the major improvement in ductility over welds made with filler rod under similar conditions.

Welds were flush on the top surface and slightly concave on the underside. There was no dropping or undercutting of the weld nugget—a common occurrence when welding steel without filler rod. Metal color ran from silvery to light-yellow scale color, indicating minimum contamination from air. A dark-blue scale color area ran along each side of the weld in the base metal approximately ⅛ in. from each edge of weld bead.

The Tests

Bend tests were made parallel to the welds, and tensile tests were made across the welds—Table I summarizes the results and shows properties of joints welded with filler metal. A decided improvement in bend ductility was made with no loss of tensile strength. Weld joints approached ductility of the base metal while joint efficiency remained above 100%.

More detailed investigation was a logical outgrowth of original tests. Efforts were made to document increased ductility and to investigate effects of welding variables on strength and ductility of joints. In addition, experimental parts were welded to determine feasibility of the process on actual parts, where obtaining tight fit-up necessary for a



3—TENSION specimens show how base metal necked and fractured outside weld zone

4—EXPERIMENTS were conducted using a manual Tig set-up such as this

without filler metal

reliable weld could be a problem.

The major improvement realized by welding without addition of filler rod can be readily explained. Loss of ductility in weld joint is due to absorption of gases such as oxygen and nitrogen from air. These gases become interstitial alloying elements that decrease ductility of resulting joint. Use of filler rod extends a path for air to penetrate the argon blanket around the weld puddle and contaminate the weld.

Eliminating the rod enables the blanket to remain unbroken and more effectively protects the molten surface of metal. Reduction in contamination from the surrounding atmosphere is the principal cause for improvement in weld ductility.

Dropping and undercutting of the weld nugget is prevented by the back-up argon gas pressure. In the original tests, this pressure was rather high, resulting in a slight concavity on the underside of the weld. The excellent fluidity of molten titanium also aids formation of a smooth, flush weld nugget.

Modifying the Variables

Subsequent tests showed that improvement in joint properties could be made by modifying welding variables. During this investigation, considerable information on effects of welding conditions on the joint characteristics was obtained.

Original tests used a copper back-up bar with ¼ in. by ⅛ in. "U"-shaped groove. Tests were performed to evaluate back-up bar material and shape of the groove.

It was found that the titanium deposited a slight smut on the copper back-up bar, which built up and eventually was picked up in subsequent welds, contaminating the titanium weld metal. Comparison of a copper back-up bar with one of a mild steel of the same configuration indicated that the high-conductivity copper sapped enough heat from the weld during operation to require an increased current setting.

Contamination Reduced

Increasing the current resulted in added weld contamination. Use of a mild steel back-up bar of low thermal-conductivity resulted in lack of chilling in the weld area, enabling reduction of the current setting. This lowered heat input and reduced air contamination of the weld metal.

The effect of back-up bar material on controlling heat distribution in the weld area prompted investigation of the shape of groove in bar. This shape and the groove dimensions can have considerable effect on heat dissipation in the weld zone. Varying size and shape of the groove changed heat transfer characteristics to a marked degree. Dimensions of the groove were found to vary with thickness of metal to be welded.

It was determined that a rectangular groove 3T wide by 3T deep (where "T" is the thickness of the metal to be welded) gave the optimum conditions of partial preheating the weld and cooling the fused joint, resulting in maximum ductility.

Low thermal conductivity of back-up bar was balanced against a fairly rapid quenching type of back-up groove to give an optimum thermal history to the weld. While no weld-area temperature curves were made, the material itself was sensitive enough to variations in temperature to indicate optimum conditions by a single bend test parallel to the weld.

Thickness of back-up bar was 0.5 in. Variation in thickness of the back-up bar had no effect on the resultant weld.

Hold-down or chill bars used for original testing were made of mild steel ½ in. thick by 2½ in. wide, chamfered on the weld side, at a 45-deg angle, to ⅛ in. thick. It was found that the only change in configuration required to improve the weld was chamfering to 1/16 in. thick on weld side, instead of ⅛ in. This placed hold-down bars nearer the weld joint.

The closer these bars were placed to joint, the less heat-oxidized zone appeared on each side of weld. The typical blue-oxide color occurring in the base metal alongside the weld was practically eliminated by optimum spacing of hold-down bars.

Pickling Bath

Photos 1 and 2 show surfaces of weld and weld area immediately after welding. The surface of the weld metal was bright; there was, at most, only trace of a heat-oxidized zone on each side of the joint. Chill bars had to be tightly clamped to the work to get the required effect on the heat

TABLE I—BEND ANGLE TO FAILURE

Sample History	Bend Parallel To Weld (2T Radius)	Bend Across Weld (2T Radius)	Bend at 45° To Weld (2T Radius)
Welded with rod	115°	115°	65°
First test without rod	160°	145°	120°
Final test without rod	190°	190°	190°

pattern in the joint during and after welding.

A 4% hydrofluoric acid—40% nitric acid bath was used to pickle the titanium sheet metal prior to welding. The metal was dipped for a time required to visually remove the scale. It was then withdrawn and rinsed in running cold water, followed by hot water to facilitate drying. Time in the acid bath varied from 1 to 15 minutes, depending on activity of the bath. This treatment removed visible surface oxide and resulted in less weld contamination.

Surface oxide in the joint area was more effectively removed by wire brushing than by the acid pickle. Oxygen and nitrogen contamination were almost eliminated on wire brushed joints. The degree of contamination was qualitatively measured by a bend test across and along the weld, and by surface color of weld metal and adjacent base metal. Either of these cleaning methods should be required when welding titanium. Welding of as-received material is not satisfactory when compared with improvement gained by acid or wire-brush cleaning.

Effects of Argon Pressure

It was determined that raising the welding machine settings increased gas absorption into the weld metal. To keep embrittling gases to a minimum, the lowest possible current setting or heat input was used. The mild steel back-up bar did much to lower the current necessary to complete a sound joint. The original setting of 70 amp was reduced to 25 amp for the same material thickness —0.040 in.—by the improvements in welding conditions made during the investigation. This low current input considerably reduced the amount of heat at the weld and increased ductility of the resulting joint.

To determine effects of argon gas pressure on the weld face, tests were performed at several different pressures. Behavior of the gas around the weld puddle was greatly improved by absence of a filler rod penetrating the argon blanket. A more protective, unimpaired blanket that flowed around the actual molten zone in a more symmetrical manner was created.

It was found that the gas pressure setting is fairly critical, and that it varies with metal thickness and machine setting. The higher the current, the greater the thickness, the higher gas flow. If too high a pressure is used, two undesirable conditions are created.

The fused joint will have concave areas along its face due to depression of the weld by argon pressure. This is not an arc-blow phenomenon, but is rather a simple depression area in the weld. In addition, close proximity and configuration of chill bars produces a valley in the joint region. High argon pressure in the area creates a gas-flow pattern that tends to roll contaminating air into the joint. Reduction of this pressure to a critical value results in optimum protection of the joint.

The effect of argon pressure out of the ceramic cup is particularly important in material 0.050 in. thick and thicker. On 0.040-in. material, the argon flow rate out of the cup was reduced from 20 cfh in the original tests to 12 cfh in final tests.

Gas pressure on the root side is the key to fusion welds where no filler metal is added. Dual function of the back-up gas is to protect the weld from gas contamination and create pressure that will prevent fused weld metal from dropping through, forming a convex protrusion on underside of weld and a concave depression along the top surface.

The flush weld, top and bottom, resulting from fusion of base metal, is a mark of flowability of the molten metal and presence of a critical argon pressure in the back-up groove.

Back-up Pressure

The back-up pressure must be closely controlled. If too great a pressure is used, the weld root will be concave in shape and will contain pits at gas-port positions. In some instances, pressure has been great enough to blow out through the weld face.

The pressure should be regulated to thickness of metal. Absolute value of the flow rate is low, and variation throughout the range of metal thicknesses tested is limted. Optimum flow rates were determined to vary from 1 cfh. For 0.040-in. material, the rate was reduced from 15 cfh in the original tests to 1 cfh in final tests.

Use of low pressures made the manner of distributing argon along the back-up groove very important. Gas ports were situated along the back-up groove at 6-in. intervals. The finish port was located about 2 in. from the sheet edge.

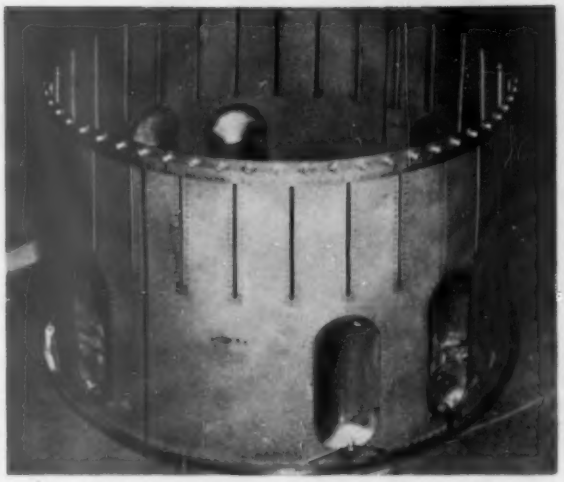
Length of the individual argon tube to each port became critical. To equalize pressure over the entire weld, all tubes leading to gas ports had to be the same length and distance from the gas manifold.

Principal shortcoming of fusion welds in commercially pure titanium has been low ductility of the resulting joint. Tensile strength of titanium fusion welds is that of the base metal or a little higher. Joint efficiency of 100-110% is assured in a sound weld. However, ductility of the joint can range from 0% elongation in 2 in. in a totally embrittled weld, to 10-15% elongation in an exceptionally ductile weld.

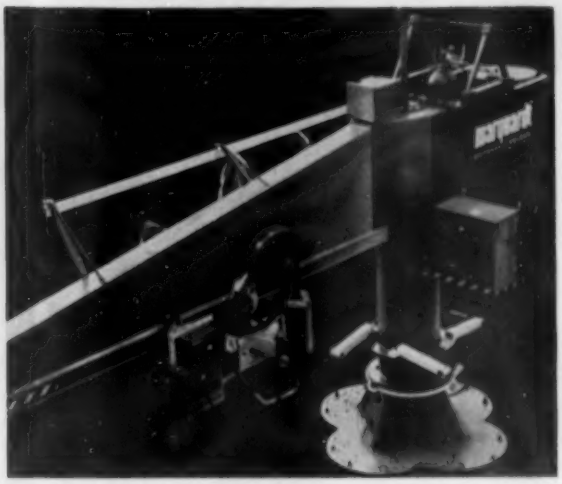
Bend ductility is also affected. In general, bend ductility of the weld has always been considerably less than that of the base metal. Fusion welding without rod has changed this picture markedly.

TABLE II—COLOR TEST

Weld Metal Surface Color	Bend Angle to Failure Over 2T Radius
Silver	180°+ (No rod)
Silver	115° (Rod added)
Light Straw	88°
Dark Straw	71°
Light Blue	66°
Dark Blue	21°
Gray Blue to Free Scale	0°



5—COMPLEX turbojet assembly contains fusion and resistance welds as well as other fabrication techniques



6—AUTOMATIC Tig set-up is expected to help overcome some limits encountered in the hand-welding experiments

Since the weld was stronger than the base metal, a standard sheet-metal weld test was not indicative of actual weld strength. As can be seen in photo 3, the base metal necked and fractured before the weld zone. Fracture strength was that of the base metal—in this case averaging out to a yield strength of 84,500 psi, an ultimate tensile strength of 102,500 psi and an elongation in 2 in. of 18.5%.

Some tests, made on fusion welds with weld metal added, cast light on performance of the weld zone. The specimens were pre-necked at the weld zone and then tested to fracture. They exhibited a tensile strength of 130,000 psi and local elongation at the weld of about 8-10%.

Properties of fusion weld without rod will lie somewhere between the above two sets of values, probably very near properties of the base metal.

The bend test of a sheet metal fusion weld is an excellent indication of its ductility. In this investigation welded samples were bent in a hand brake over a 2T radius. Table I is a summary of bend-test results.

A significant improvement can be seen in ductility of a weld made without filler rod over that made with filler rod. Ductility improves when welding conditions, under which fused welds are made, are improved.

Ductility of a fusion-welded titanium joint can be roughly determined by surface color of the weld. The amount of gas contamination (and resultant embrittlement in the weld) is indicated by thickness of oxide layer appearing on the surface.

Color Test

As this oxide layer grows in thickness, it goes through a scale-color phenomenon similar to that of steel. Table II lists these colors and the resultant bend angle to failure.

The fusion-welding specification for titanium at Marquardt limits acceptable fusion welds to those with a light straw color or bright, silvery appearance on the weld metal surface. A dark straw, blue or gray color, or free scale on the surface is cause for rejection.

It has been found that the bright silvery appearance is easier to obtain when weld rod is not added. All bend-test comparisons, whether with rod or without, were made with welds that had a bright silvery appearance.

The fusion-welded joint made without a filler rod has been successfully tried in limited production and is now successfully performing in service applications. Photo 5 is a complex titanium assembly containing one such joint several inches in length.

This assembly also contains considerable resistance welding; a hot spun "Z" ring; several hot-formed, bathtub-type parts, some of which have been contour fusion-welded; riveted fasteners; and several other sheet-metal fabrication techniques. The part is used on a turbo-jet engine and saves considerable weight over use of steel.

To date, no-rod-added welds have been limited to longitudinal tight butt joints made manually in commercially pure titanium 0.062 in. thick or thinner. However, with further work and use of new automatic welding devices, such as illustrated in photo 6, these limits should eventually be erased.

Use of a Tig machine that can weld longitudinally, circumferentially or over a contour with equal ease will enable us to weld titanium in any shape and over a wide range of thicknesses without adding filler rod.

It is also felt the technique of welding without rod, either by hand or automatically, will be suited to welding of titanium alloys as well as commercially pure titanium.

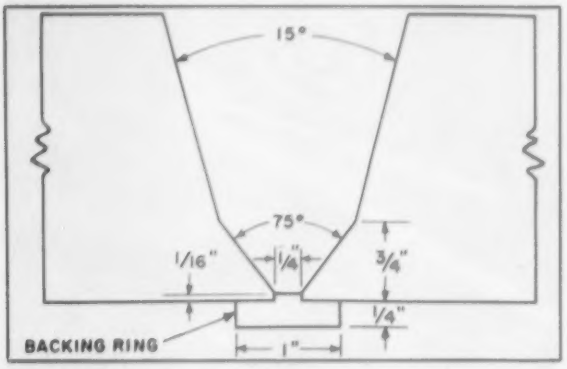
New pipe process . . .

(Continued from page 37)

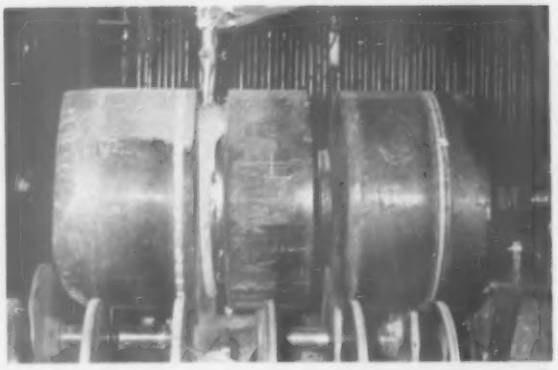
weld strength.

Kellogg says weld quality obtained by this process meets X-ray, physical, and mechanical requirements of the ASME Boiler Code, and other codes and specifications. Tensile, bend, impact and torsion tests have demonstrated properties of higher quality, it is further claimed.

Although first used commercially in the shop fabrication and field installation of high-pressure, high-temperature stainless-steel power piping, the process is being applied successfully to many other difficult welding applications, Kellogg states. It is applicable to any metal or alloy which can be fusion welded.

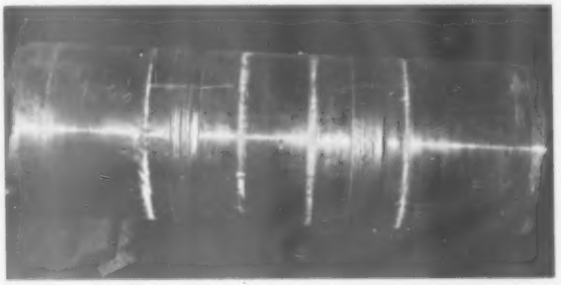


1—WELD-joint design used for the pressure vessels. A backing ring was used for fittings and to facilitate complete penetration without need of inside finishing



2—SUBMERGED-arc welding head is positioned over joint. It took 800 passes to complete both joints, and 265 lb of weld metal was deposited

X-ray quality welds through submerged-arc



3—PRESSURE vessel just after welding. Complete X-ray inspection followed

SUBMERGED-ARC welding was recently put to test in the fabrication of a number of heavy-walled pressure vessels. The largest of these vessels, made by the Cameron Iron Works, Houston, Texas, had a wall thickness of 7½ in. and was required to withstand a test pressure of 27,000 psi.

This meant that weld quality had to be of the highest order. All welds had to pass 100% X-ray inspection before the vessels were released for shipment. The sound, porosity-free welds produced by the submerged-arc process passed this rigid requirement the first time. Company officials said the job could not have been accomplished economically without the help of this high-speed welding method.

The largest pressure vessel was made in three sections of forged AISI 1029 steel. This assembly measured 44¾ in. in length by 24 in. in diameter. Inside diameter was 9 in., with a wall thickness of 7½ in.

Double-Angle Vee Joint

Service engineers representing the manufacturer of the submerged-arc equipment met frequently with Cameron's welding department engineers to work out welding conditions and a weld joint design for this particular job. The result was an unusual double-angle vee joint, illustrated above.

The nose of this joint was 1/16 in. thick. From this nose a 37½-deg bevel rose to a level ¾ in. above the inside diameter. The remaining bevel was made 7½ deg from vertical to the outside diameter. A backing ring, 1 in. wide, 3/16 in. thick, and with a 1/16-in.-by-¼-in. shoulder was inserted for fit-up purposes. This ring was held by tack welds.

800 Passes!

Before actual welding, the weld area was preheated to 400-500 F. The welding head was then positioned over the joint and the welding operation was started (photo 2). A total of 265 lb of weld metal was deposited in these two joints in 800 passes (photo 3). Each pass was visually inspected to make sure that the weld was clean and free from porosity and cracks. Because the welding conditions were precisely controlled, no weld cracking occurred.

The first pass, which was required to be completely welded to the backing ring, was deposited at 475 amp, 28 volts, using ⅛-in. welding wire. A change was then made to 5/32-in. welding wire, and the welding current gradually increased to 700 amp, 34 volts, for the fourth and succeeding passes. Speed was 18 to 20 ipm.

After welding, the entire vessel was stress-relieved and the welds were ground or machined flush with the outside diameter (photo 4). Inside finishing was not necessary and would have been difficult because the end openings were only 2 in. in diameter.

4—COMPLETED vessel, machined and ground to a smooth finish

—Photos courtesy Linde Air Products Co.

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No. 604-3-C
No. 606-3-C

No. 700-3-C
No. 702-3-C

Inside view showing INNER BIB of "Series 400" Helmets for extra protection to welder's neck from flashes and reflected glare.

*OWENS-CORNING TRADE MARK

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No. 402-3-C with #1085—Insulated Steel Glass Holder

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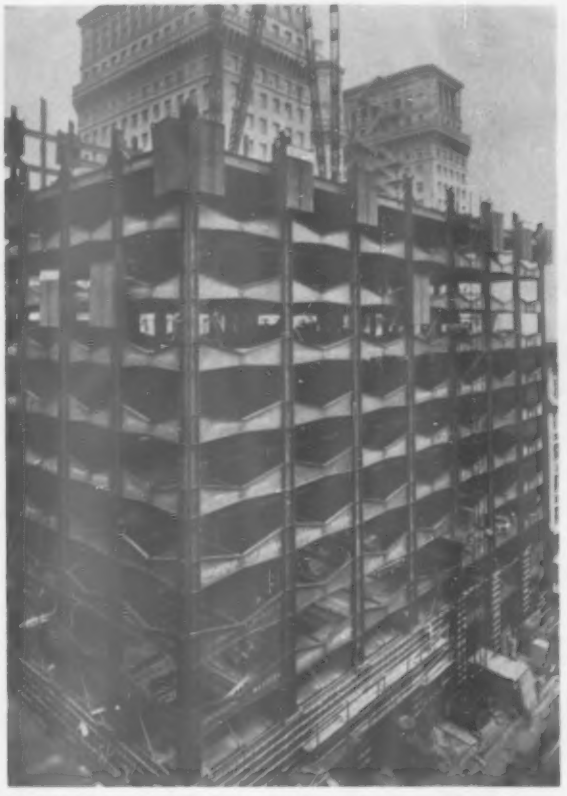
DRAWING of the 25-story Equitable Life Assurance Building in San Francisco—the city's first skyscraper since enactment of its strict building code in 1948



TAPERED, continuously welded columns and "butterfly" spandrel beams are welded to columns. Note continuously welded 90-deg corner column

Unique design used in welded skyscraper

BY MERRILL F. YALE
The Lincoln Electric Co.

WHEN San Francisco enacted its earthquake-minded building code in 1948, it was widely predicted that no more tall buildings would ever again be built in the city of the Golden Gate.

Yet there stands today—thanks to ingenious application of welding design—a 25-story skyscraper that meets all city specifications, including requirements for shears twice those of the Unified Building Code. (WELDING ENGINEER first reported on preliminary construction of the building in September, 1954, page 6).

The handsome structure, first skyscraper since the local ordinance, was built by the Equitable Life Assurance Society. The ultramodern building is air conditioned and has automatic elevators. It provides 364,000 sq ft of office space.

Welding was widely used throughout the design, beginning with the piles, which were welded at the joints. In addition, reinforcing flange plates were welded to the pile tips for driving purposes. Approximately 460 piles, averaging about 120 ft in length, were driven to support the new edifice.

"Butterfly" Beams

Features of the welded design are an unusual tapered column and tapered or "butterfly," spandrel beams. Exterior columns and spandrels are designed to carry all lateral and seismic loads. This reduced the size of interior columns and beams to permit placing of large amounts of duct work. Interior columns take only vertical loading.

Because of the high shears involved (imposed by seismic and wind load requirements), large sections of welded plate had to be used in exterior columns and spandrels. The difficulty encountered in splicing heavy flanges as column depth changed in going up the building led to the idea of a tapered column. The column width in the lower floors had to be increased to carry the greater lateral forces.

The wide spandrel beams help to reduce these bending stresses by reducing the clear column height between spandrels. They also act as horizontal beams to keep column flanges from rotating. The reason for sloping the flanges of the spandrel

Submerged and manual-arc welding processes were used...

MAKING beam flange to column joint. Plate preparation permits full weld. Note run-off tabs, used to get full section at edges of flange

WELDOR joins web of spandrel beams to column. Note intermittent welds. Welding cages and protective booths were widely used

WELDORS at work on double-corner column. Like all exterior columns in the structure, these are tapered and continuously welded

EXTERIOR tapered column is against wall of adjoining building at lower level. Column connections were field welded

CLOSE-up of finished weld between beam flange and column

beams (creating the "butterfly" design): to meet the floor beam at midspan and give the flanges support. Beam depth is 5 ft 6 in. at column face and 2 ft at midspan.

The columns taper in web size from 42 by 1½ in. at the base to 12 in. at the 14th story, and in flange size from 18 by 3 in. to 16 in. Maximum flanges of the tapered spandrel beams are 10 in. by 1⅝ in. Web plates are generally 7/16 in.

Submerged-Arc Welded

Columns and spandrels were fabricated by the automatic submerged-arc welding process. Full butt welds were used on flanges and double fillet welds on webs.

In designing the structure, the welding of beam flange to column was a subject of much discussion. It was felt that shrinkage would cause the weld to crack, especially in lower sections where the columns would be stiff and unyielding.

It was decided to make a bolted joint at midspan. This joint was left loose while the weld was made, allowing the weld to shrink. To simplify erection, the fabricator welded top and bottom plates to the flanges at midspan, holding the beams in one piece. These plates were burned free before completing the weld at the columns.

Field welding was done with E-6010 electrodes. When cracking was encountered in root passes of the joints in heavy sections, the root pass was made with an E-7016 (low-hydrogen) electrode.

Fabricators and erectors of the Equitable Building were Consolidated Western Steel Division of U. S. Steel Corp.; general contractors, Dinwiddie Construction Co.; structural engineers, F. W. Kellberg and Associates; architects, Loubet & Glynn Associates and the late W. D. Peugh; consulting architect, Irwin Clavan.

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—American Brass Co. Photo

—Storts Photo

LEFT—Portion of completed degreasing tank with heating and cooling coils installed. It is ready for operation

ABOVE—Side plate is welded to the formed bottom component. Note simple arrangement for clamping seam assembly to channel support

Degreasing tanks welded by inert-gas process

BY HAROLD S. CARD

THE Tig (tungsten inert-gas) and Mig (metal inert-gas) processes are being used to good advantage by fabricators of copper and copper-silicon alloys. High current densities give a concentrated heat at the arc, making it possible to move along the line of weld rapidly and accomplish fusion with minimum heat input into the adjacent metal. The shielding blanket of inert gas prevents oxidation and discoloring and leaves no slag residue. When welding thin sections, the low total heat input minimizes distortion.

Good weldability and corrosion resistance were important considerations in the selection of Everdur for the fabrication of a tank to be used for degreasing. The trichlorethylene solution used in the degreasing process may become definitely corrosive. When overheated or saturated with water, it breaks down to form hydrochloric acid—a highly corrosive compound.

Experience has shown that steel tanks will last only two or three years, whereas an Everdur tank which has been in service for 12 years still shows no sign of serious corrosion. When maintenance and replacement are taken into account, real economy favors use of the higher-cost material.

Replacement necessary because of corrosion failure would, in fact, be a major operation. As fabricated, the tank is 30 ft long, 6 ft deep and 2 ft wide and is partly sunk in a pit. There are numerous connections for steam and water, used for heating and cooling, and outlets for draining. The resistance of the copper-silicon alloy to corrosion avoids dismantling and re-installation expense.

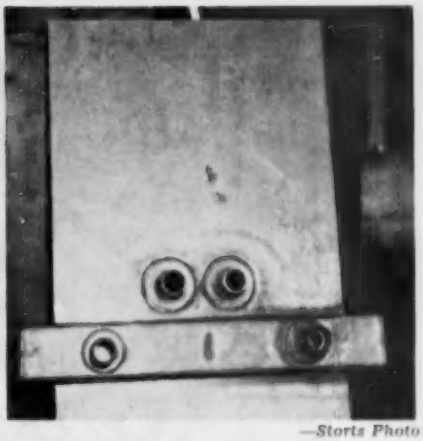
The manual inert-gas arc welding process was used by Storts Welding Co., Meriden, Conn. (specialists in welding stainless steels and non-ferrous alloys for service under corrosive conditions) because of ease and speed of welding, and because experience indicated sound deposits could be expected from it on Everdur. Freedom from porosity is very important when welds are exposed to corrosive media, as those in such tanks are.

Material for the entire tank was ⅛-in. Everdur. It was fabricated in three 10-ft sections. One end section was welded to the center section in the shop; the two parts were then shipped by truck to the installation site. There they were set up over the pit for final assembly to minimize the amount of handling of the 30-ft tank after completion.

Each of the three sections required three pieces of plate for bottom and sides. The bottom is a 4-ft-by-10-ft plate formed into a 10-ft-long chan-

—Storts Photo

FITTINGS are welded to short lengths of water-jacket channel which go on end plates



—Storts Photo

END plate with fittings and channel welded to it

nel having a 24-in. web and 12-in. legs. To these legs were butt welded plates 5 ft by 10 ft. End plates are 2 ft by 6 ft.

A water-cooling jacket consisting of a formed channel with 4-in. web and 2½-in. legs was welded to the outside of the shell 3½ ft above the bottom of the tank. A 2-in. formed angle welded to the inside just below the level of the water jacket, forms a trough around the inside. When vapor from the degreasing solution condenses and runs down on the upper wall surface, it collects in the trough and is drained away for reuse.

Argon Was Shield

All shell seams on the tank are square butt joints. Square corner welds were used for joining end plates to sides and bottom. All butt joints and corner joints were double welded (that is, welded both outside and inside), using ⅛-in.-diameter Everdur bare welding wire as a filler. Argon was used as shielding gas at a flow of 15 cfh. The current was 130 amp d-c, and arc length was ⅛ in. Single-pass welding was used throughout, with no preheat.

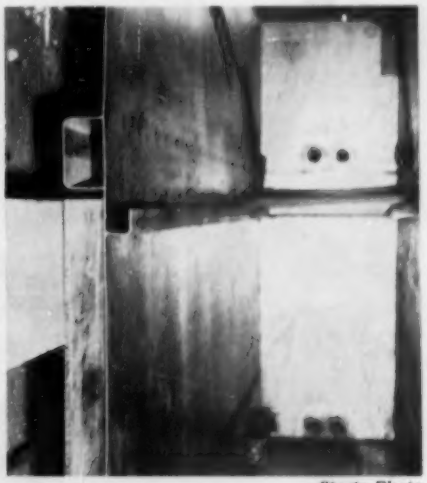
First stage of assembly was welding the required fittings to the water-jacket channels and shell plates. Then proper lengths of channel were welded to end plates, and interior angles were added to make the end subassemblies complete. Assembly of shell plates was arranged so that welding could be done in downhand position. The bottom piece and one side sheet were set up with a steel channel supporting the seam, the inside surface facing upward. This seam was tacked and welded.

The other side sheet was then clamped in position and the seam tacked and welded on the outside. The end plate was tacked in position and welded along the top corner, and the water-jacket channel welded in place. The section was turned over and welding sequence repeated. This procedure allowed a maximum of downhand welding at one set-up, thereby completing the job with a minimum of handling.

Great care was taken to insure dimensional accuracy of the three sections, so that no difficulties were encountered in the fit-up of the final assembly.

—American Brass Co. Photo

WATER-jacket channel is welded to tank shell by Tig (tungsten inert-gas) process



—Storts Photo

INSIDE view shows relative positions of channel and inside trough

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Spot-welding cooling requirements

By LOUIS J. MURPHY

REFRIGERATED electrodes for spot welding of aluminum and steel produce better quality welds and greater work consistency at higher production rates. Though the exact quantity of heat that must be removed in a particular resistance-welding operation is difficult to compute accurately, experience shows a fairly close approximation is possible.

The accompanying chart permits use of the usual approximations to determine the quantity of heat to be removed, or the refrigeration capacity in tons, to handle this heat load.

Example: How much heat must be removed from an electrode during spot welding of aluminum if the welding rate is 60 spots per minute?

Solution: Usual heat release per spot weld during resistance welding of aluminum is 1.5 to 1.7 btu per spot. Assuming an average release of 1.6 btu per spot for this job, enter the chart on the left at 60 spots per minute and draw a straight line through 1.6 btu per spot on the right. At the intersection with the central scale read the heat release at 5,800 btu per hour, or just under 0.5 tons of refrigeration. This chart is based on:

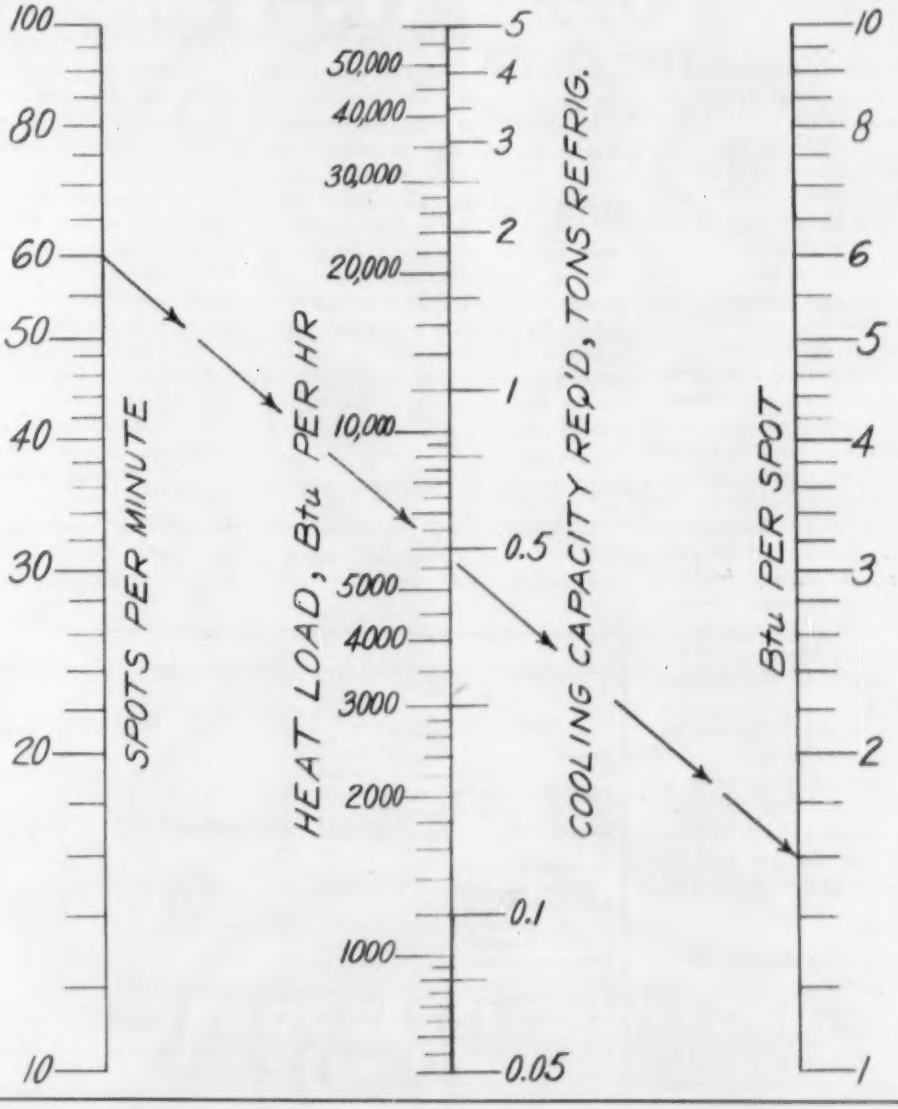
H = 60 (SB);

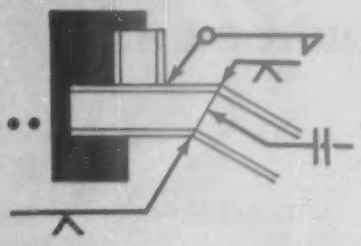
H = heat release, btu per hour;

S = welding speed, spots per minute;

B = heat release per spot, btu per minute.

The approximations given for aluminum are also satisfactory for some classes of steel welding, but not all. However, the spot heat-release scale covers a wide enough range to permit solution of almost every spot-welding problem met in usual practice.





the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Function of the electrode coating

Question:

What is the purpose of the welding-electrode coating, and what are some of the materials used?

Answer:

Electrode coatings are designed to be the automatic cleaning and deoxidizing agents of arc welding, and the materials comprising them accomplish this purpose. As the coating burns, it provides a gaseous inert atmosphere that protects the end of the electrode as well as the molten weld pool. This atmosphere excludes harmful oxygen and nitrogen from the molten weld area, while the burnt residue of the coating forms a slag to cover deposited weld metal.

The slag that is formed also serves to exclude oxygen and nitrogen from the weld until it has cooled to a point where oxides and nitrides will no longer be formed. In addition, the slag also serves to slow the cooling, thus producing a more ductile weld.

Besides the deoxidizing features, there are other advantages of coatings. It is difficult to list these in the order of their importance since circumstances may alter the thinking on the subject.

The coating serves to improve the deposit and general performance of the welding electrode. It provides an easier striking arc, helps to maintain the arc, regulates depth of penetration, stabilizes the arc and improves the X-ray quality of the weld.

Protective Slag

Sometimes it adds alloying agents to the weld metal or restores lost alloys. The resultant slag not only protects the weld bead but assists in shaping it. This slag, formed by the combination of coating materials, must also be easily removable.

In addition to these functions which it provides during the actual welding operation, the coating serves as an insulation for the electrode's core wire, and it may determine the voltage required. It may even determine the welding position best suited for the electrode.

It can thus be seen that composition of the coating is extremely important. The coating should have a melting point somewhat lower than the core wire on the base metal. It must also be of a lower density in order to be quickly and thoroughly expelled from the molten weld metal. Where the electrode is to be used for overhead or vertical welding, the slag formed from the melted coating must have a high viscosity so that it will adhere and freeze in a gravity-defying position.

It's an Art

The blending of proper ingredients is indeed an art. Flux (or coating) compositions are usually guarded with considerable secrecy. Fundamentally, they consist of acid, basic, and/or neutral slag-forming materials; arc stabilizers; deoxidizers and/or alloying materials; organic materials (if desired); and a solution of sodium silicate for a binder.

No sharp distinction can be drawn as to the function of any single ingredient of the coating. Each, directly or indirectly, influences one or more functions of the composite flux. Silica, manganese dioxide, iron oxides, feldspar and titanium dioxide may act as slag-forming materials. Ferro manganese, ferro silicon and manganese-silicon compounds usually function in the dual capacity of deoxidizer and alloying additions.

Minerals used as arc stabilizers include titanium oxide (which enables a longer arc to be maintained), iron oxide, magnesium oxide, lime, sodium and potassium minerals or compounds, and thorium oxide (which decreases arc wandering at the electrode tip). Stability often includes smoothness and minimum sputter.

ESSENTIAL COATING COMPOSITION OF MILD-STEEL ELECTRODES

Coating materials	E6010	E6011	E6012	E6013	E6020 E6030	E6015 E6016
Organics, Gums, Resins, Cellulose	L	L	S	M	S	—
Feldspars, Alkali Aluminum Silicates	S	S	M	M	S	—
Clays, Aluminum Silicates	S	S	S	S	S	S
Talcs, Magnesium Silicates	S	S	S	S	S	—
Asbestos	M	M	S	S	S	—
Silica	—	—	—	—	M	—
Titanates, Rutile TiO_2, Sodium and Potassium Silicates	M	M	L	L	—	M
Iron Oxide	—	—	S	S	L	S
Calcium Carbonate	S	S	S	S	S	L
Calcium Fluoride	—	—	—	—	—	M
Potassium Silicate	—	M	S	L	—	M
Sodium Silicate	L	S	L	S	M	M
Ferro Manganese	M	M	M	S	L	M
Ferro Silicon	—	—	—	—	—	M

S = small quantities or optional. M = medium quantities. L = large quantities.

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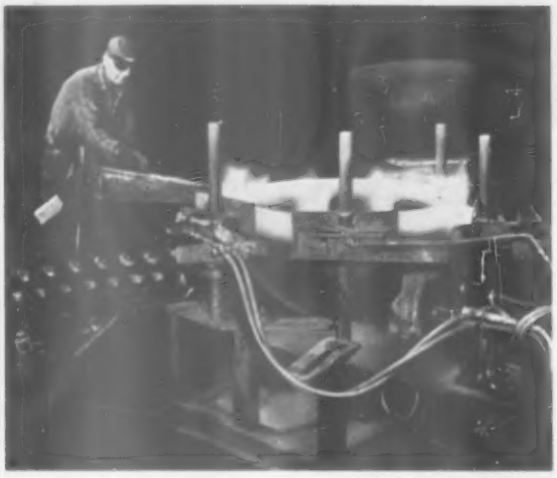


GAS burners stress-relieve periphery of ¼-in. thick rim for depth of about 6 in.

Magnets in welding

HART & Cooley Mfg. Co., Holland, Mich., producer of warm air registers, grills and diffusers of all types for heating purposes, uses specially-developed fixtures to clamp and spot weld automatically the four sides of a register in a single operation at a rapid rate.

The firm's efficiency has increased since the introduction of a pair of permanent magnets which solve tiresome procedure problems and increase production.

The magnetic setup is located on a table almost chest-high to the worker. The welding fixture consists of two non-magnetic guide bars, at a 90 deg angle from each other. These bars are located so that when two frame ends are brought together, the precut 45-deg corner ends of the frame sections protrude beyond the bars to butt tightly together.

A pair of horseshoe-shaped permanent magnets act as automatic holding devices. One magnet located about 6 in. from the end of each guide bar. With a 25-lb pull, the magnets keep the frame secure during the welding.

In processing the work, the operator of the 75-kva welding unit simply picks up two frame sections and end-butts them against the magnetic positioning bars. He then places a tiny triangular piece of steel across the top of the butted 45-deg corners of the two frame sections and actuates the welder. The job is finished as three more spot welds and two other frame members are added.

Heat during the welding process necessitates remagnetizing every three weeks.

—Carboloy Dept.

* * *

Airless blasting

Acme Industries, Inc., Jackson, Mich., has to perform a considerable amount of welding and brazing in the manufacture of refrigeration condensers, heat exchangers and oil separators for air-conditioning units. Tubes are silver brazed into tube sheets and stamped heads. Various kinds of heads and sheets are welded into shells.

Perfectly clean metal is needed for good silver brazing and welding. This is provided by a vigorous shot blast in a multiple-table airless blasting machine. Just one machine accommodates heads sized from 4 in. in diameter by 2 in. deep up to 14 in. in diameter by 4 in. deep. Square tube sheets of similar sizes are likewise blasted clean without the need for compressed air.

—American Wheelabrator & Equipment Corp.

Stress-relieved gas caps

FABRICATORS of high-pressure steel tanks used to store liquefied-petroleum gas have had trouble from cracks appearing along the rims of hemispherical heads forming the ends of these tanks. For economical reasons, these heads are cold-pressed. The cold-pressing leaves the area along the rim more brittle than if it were stress-relieved. Given a hard bump or bang during assembly operations, cracks often appeared. The problem was to turn out a cold-worked, dome-shaped "gas cap" in which the hardend area that might produce these cracks was eliminated.

After a thorough study of the problem, Lukens Steel Co., Coatesville, Pa., came up with an assembly-line technique of producing stress-relieved rims on cold-worked domes.

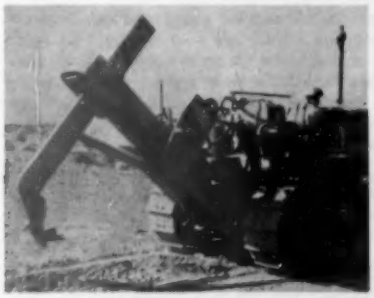
Removal of cold-working stresses —which may run as high as 100,000 psi in this type of head—gives greater safety and better weldability.

This photo group shows: right, a newly fabricated ripper tooth boot (back side) welded from mild steel plate; center, hard-faced with stringer beads of Coated Tube Stoodite, and left, front side of worn boot after 3 days' service.

HARD-FACED RIPPER TOOTH

Lasts 1200% Longer on Desert Duty!

Near Ludlow, California, PG&E is spanning the vast Mojave Desert with a gas pipeline. To ease the trenching job a gigantic ripper is towed by a D7 tractor ahead of the ditcher. Its purpose is to break up the hard-packed earth and locate the frequent sub-surface lava flows. This lava is so hard and tightly bonded that explosives must be used to break up the formation.



Depth at which ripper operates is evident by length of standard.

The ripper on this job is designed for easy maintenance; boot type point and adapter are replaceable. The points are fabricated from mild steel plate in the

Close-up shows point attached to tooth adapter. Entire tooth is hard-faced with Coated Tube Stoodite.

division headquarters maintenance shop of the pipeline company handling the job, Engineers Limited Pipeline Co., Bakersfield, California. All four sides are hard-faced with Coated Tube Stoodite before being placed in service.

Working deep in the highly abrasive earth, unprotected boots last only 2 hours. When hard-faced with Coated Tube Stoodite this short life is extended to three full days—an increase of 1200%.

Coated Tube Stoodite is a recent Stoody development for manual application, combining high wear resistance, good impact strength, fast deposition and low cost. Ask your Stoody dealer for details (consult the yellow pages of your phone book) or write direct.

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Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.

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The first machine to give you either AC or DC current at the flip of a switch.

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Four sizes—200, 300, 400, and 500 amps.

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For mild steel, cast iron, "hard-to-weld" steels, stainless steels, hard surfacing.

Just think - 7 welders in 1

. . . save money on every job with this versatile AC/DC P&H Welder

"This new AC/DC P&H Welder beats anything we have ever used." That's what Lawrence Beggs of the Research Weld Co., Racine, Wisconsin, says.

"Ours is mostly precision work," Mr. Beggs continues, "involving Heliarc® welding of stainless, aluminum, and magnesium. We can switch from DC for welding stainless to AC for aluminum or magnesium, as easily as turning on a light. With its automatic high-frequency and instant response to control, this machine is wonderfully easy to use. We have had new men make acceptable welds with it after just a few minutes' instruction."

And you can't beat this new AC/DC machine for flexibility. You can use it for metallic arc welding, either AC or DC, straight or reverse. It can be used with Automatic Heliarc® AC or DC welding, or the Sigma Welding Process. It can even be adapted for use as an AC or DC Spot Welder.

Two models (200 and 300 amps) give you the range of capacity you need. Call your nearby P&H representative or distributor for an eye-opening demonstration of this remarkable new welder or write us for complete details — now. Welding Division, Harnischfeger Corporation, 4513 W. National Ave., Milwaukee 46, Wisconsin.

®T. M. Linde Air Products Co.

HARNISCHFEGER

the **P&H** *Line*

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada

new products . . . . . USE CARD ON PAGE 99

PLANISHING roll smooths fusion welds and rolls welds on steel and other metals

X-RAY machine is designed to examine welds at a short focus-film distance

Weld roll

AUTOMATIC weld area planishing roll smooths fusion welds and rolls welds on steel and all other metals. It is said to increase physical properties and refine the grain of weld and adjacent area and provide controlled cold working of weld and heat affected zone.

The manufacturer asserts that it reduces grinding operations and assists spinning, bulge forming and sizing operations, rolls welds on flat sheets, cylinder and cones. It accommodates diameters of 1¾ in. to 10 ft, lengths to 10 ft. *Airline Welding and Engineering.*

Circle No. 50.

* * *

Pilot valve

NEW solenoid pilot valve for automatic control of hydraulic circuits is the sub-plate mounted type for panel mounting installation and is designed for 3,000 psi. Flow capacity is 3.6 gpm at 15 ft per second. Seven spool designs are available for any circuit control. *Rivett Lathe & Grinder, Inc.*

Circle No. 51.

* * *

Illumination kit

ACCURACY of production and inspection procedures is increased, work is speeded and simplified by the "G-S Syte-Ayde," which provides light in out-of-the-way places, according to the manufacturer.

It is powered by flashlight batteries and provides four light transmitting rods. Two are straight 3½ in. and 6 in. long and two, of the same length, are bent 90 deg.

Three 1½ power mirrors, ½ in., ¾ in., and 1¼ in. in diameter are supplied with clips which fit rod ends. All parts are contained in separate compartments of a plastic kit. This kit is used by die makers, pattern makers, tool makers, machinists, trouble shooters, inspectors, engineers, model craftsmen, doctors and dentists. *General Scientific Equipment Co.*

Circle No. 52.

* * *

Solder

PACKAGED in an unbreakable squeeze bottle, "Redi-Mix" solder is a mixture of fine-powdered solder and an active flux. The product is a creamy paste that spreads on any area to be bonded. It is available in trial size, approximately 3 oz, and regular ½ lb and lb size bottles. *Anchor Metal Co.*

Circle No. 53.

* * *

Electrode

A NEW 11% - 13½% manganese-nickel-steel welding electrode is said to have all the ease of handling associated with mild or stainless steel electrodes, yet it is a genuine manganese-nickel-steel electrode with all the alloys in the wire, not in the coating.

"Flo-kote" coating, according to the manufacturer, eliminates peening, weaving the bead and puddling the arc; sound stringer beads can be run without porosity or cracking. They can be run vertically or overhead as well as downhand. *Stulz-Sickles Co.*

Circle No. 54.

X-ray machine

"FEDREX 120 s" is designed for the examination of welds at a short focus-film-distance. In spite of the high rating of 120 kvp, 5 ma, weight of the unit is only 75 lb, according to manufacturer.

Short exposures, easy handling and economy in service are said to be due to a high definition X-ray tube and a short focus-film-distance.

It will penetrate up to 1¼ in. of steel. The control unit weighs 65 lb and the connection cable 13 lb.

Three other models of similar X-ray machines have maximum penetration ratings of approximately 2, 3 and 4 in. *Machinery & Welder Corp.*

Circle No. 55.

* * *

Goggle

"No. 100" goggle is designed for use by workers in dusty air or near splashing liquids. It is said to be contoured and moulded from soft, flexible synthetic rubber to provide snug fit, complete protection, day-long comfort and can be worn over most glasses.

The manufacturer says the wide transparent plastic window gives full width of vision and fits in deep holding grooves in the soft rubber frame. On each side there are baffled ventilator holes which are said to permit a circulation of air and prevent fogging. The flat elastic headband is easy to adjust and holds the goggles securely in place. *Chicago Eye Shield Co.*

Circle No. 56.

Arc welder

A NEW electric-motor-driven d-c arc welder has a welding range of 5 to 300 amp.

It is said to have normal rating of 200-amp for average welding work and the added ability to get down to exceptionally low heats for best results in welding very light gauge metals such as used in aircraft welding, body and fender work.

Model "MBT-204" has a special resistance unit connected in the lowest range setting of the main selector switch to make possible the very low welding heat, according to the manufacturer. This unit is mounted under a special hood on the back of the control cabinet so as to dissipate its functional heat outside the welder. *Hobart Brothers Co.*

Circle No. 57.

* * *

Positioner

VERSATILE unit for positioning both the weldment and the automatic welding head is recommended for metal fabricating shops or experimental laboratories using or contemplating automatic welding, states the manufacturer.

The work can be positioned or rotated under the welding head, which is adjustable. There is a 360-deg rotation of the mast and ram. *C. B. Herrick Mfg. Corp.*

Circle No. 58.

Electrode

IMPROVED flux coating, rapid burn-off rate, porosity-free deposits and smooth-flowing characteristics makes "Mir-O-Col No. 2" useful in rebuilding heavy-duty equipment, it is claimed. It can be used as general hard-facing rod; it is best applied to large sections by electric arc process. Application in single narrow beads or heavy weave passes does not chip, spall or break at the bond. Deposits bond equally well with either parent metal or other hardfacing deposits. Electrode has high red hardness and is forgeable at red heat but not machineable. Rockwell C scale is 54 to 57. Full range of sizes is available. *Mir-O-Col Alloy Co., Inc.*

Circle No. 59.

* * *

Welder

"HANDY-Giant" welder is lightweight, durable, powerful and safe, according to manufacturer's claim. No glasses are needed in the operation of this welder which uses 6 volts. It operates on 115-volt, 60-cycle a-c house current and also from car, truck, tractor or boat batteries. It is designed for welding, brazing, soldering and etching and cutting holes in metal. *Cauhorn Mfg. Co.*

Circle No. 60.

* * *

Fluxing system

AUTOMATIC fluxing system for production and maintenance brazing operations meters liquid flux into the fuel gas according to the size of the brazing tip and regulator pressures. It is said to be sized to carry a charge for a work-week of brazing operations, and it can be attached to the welder's hand truck or to the fuel line at the production brazing station.

It was created mainly for production brazing of carbon and low alloy steels, brass and copper base alloys and Monel. *All-State Welding Alloys Co., Inc.*

Circle No. 61.

For more information use card on page 99

Acetylene torch

A NEWLY developed multipurpose acetylene torch outfit is an improved design for use in the plumbing, automotive repair, electrical, refrigeration, sheet metal, jewelry and other allied fields.

The torch is lightweight and said to be well-balanced to eliminate operator fatigue, and the heads run cool enough so that they can be handled immediately after an operation, which facilitates quick changing. The torch also provides "pencil flame" for electrical work and has copper heads suited for sheet metal jobs.

Outfit includes two handle assemblies and seven different head styles, covering the full range of heating and soldering work for the trades. *Ransome Co.*

Circle No. 62.

* * *

Portable grinder

POWER of a new 6-in. portable grinder has been upped 85% through the introduction of a new motor tailored to grinding operations, according to the manufacturer. Tool weight, however, has been reduced to 1½ lb.

The grinder is designed for continuous duty. It uses lubricant- sealed ball-bearings. *Black & Decker Mfg. Co.*

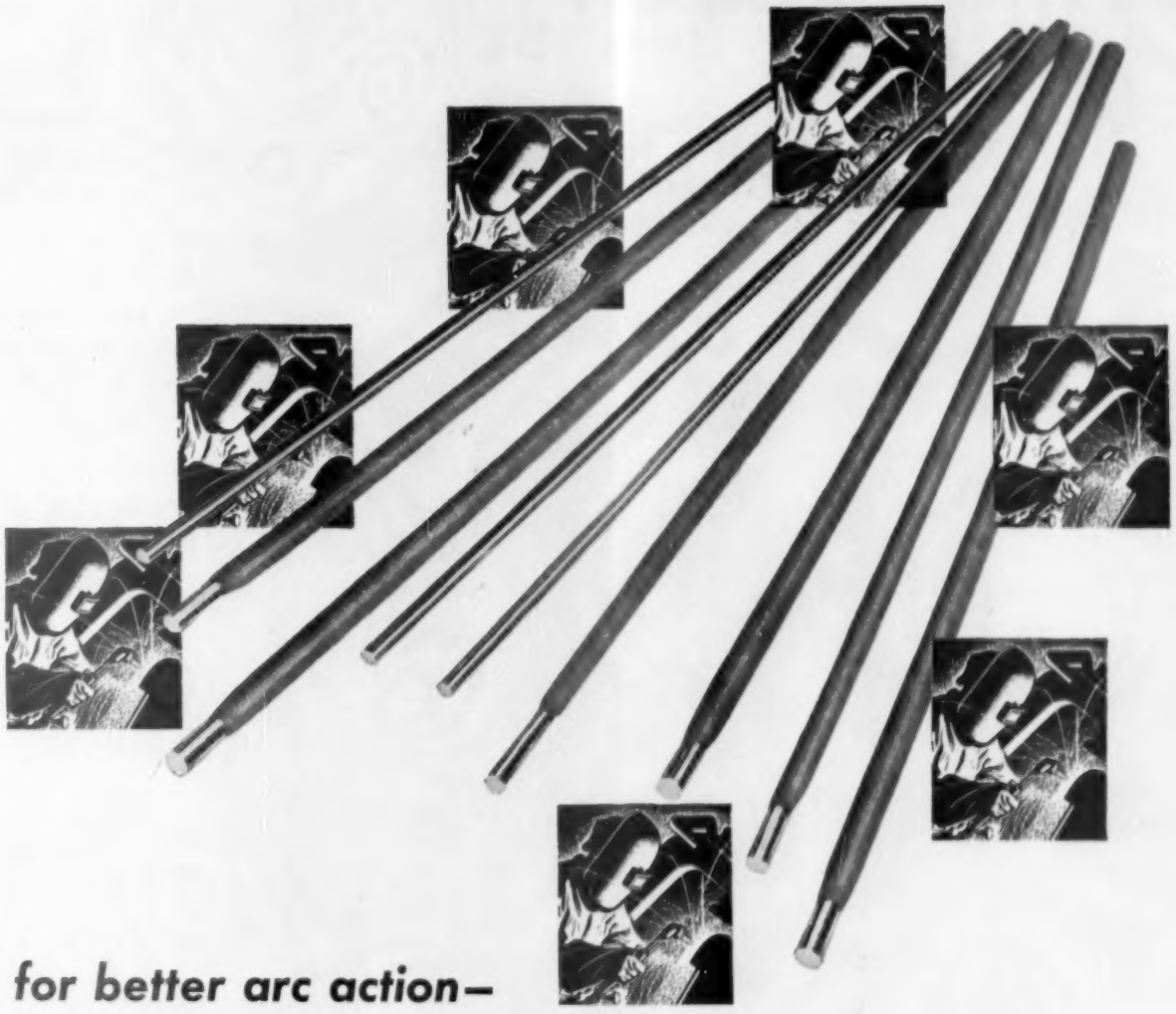
Circle No. 63.

* * *

Grinding compound

SYNTHETIC water-soluble compound for use in industrial cutting and grinding is said to leave no hard deposit on machinery. By leaving only soft residue on machines, "Vantrol 5615" is capable of increasing tool life and speeds and cutting maintenance costs, it is claimed. *Van Straaten Chemical Co.*

Circle No. 64.



for better arc action—

USE CRUCIBLE REXWELD, *hard-facing rods*

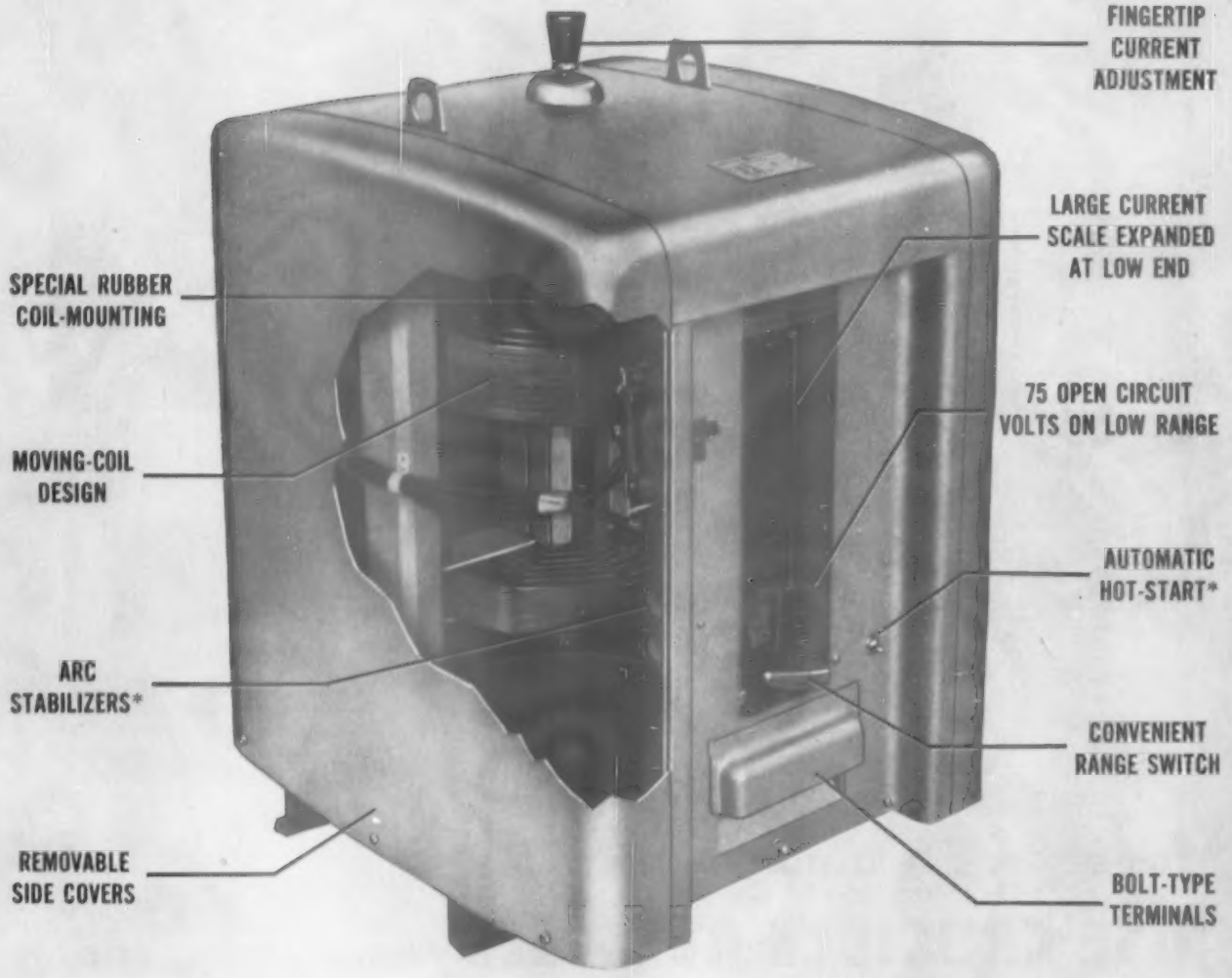
Rexweld low hydrogen coated electrodes are easy to apply. That's because they provide improved weldability . . . more stable and direct arc. Welding can be performed both in vertical and horizontal positions. And with Rexweld you'll get denser welds . . . no porosity. Parts will resist chipping, deformation or heat checking better . . . and they can be Rexwelded again and again.

Get Rexweld rods from your local Crucible warehouse in both low hydrogen coated electrodes and bare rods, in a wide range of grades and sizes. Next time you have a hard-facing application use Rexweld. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

WELDING ARCS NEWS



*Improved Arc-performance Features, Available Optionally

Check the G-E welding distributor near you . . .

Alabama: Birmingham—Alabama Oxygen, Young & Vann Supply; Mobile—Turner Supply

Arizona: Phoenix—Consolidated Welding Supply

California: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, Ventura—Victor Equipment

Colorado: Boulder, Colorado Springs, Denver, Durango, Ft. Collins, Ft. Morgan, Greeley, LaJunta, Longmont, Pueblo, Sterling—Hendrie & Bolthoff

Connecticut: Hartford, New Haven—Harris Company

Florida: Hollywood—Florida Gas & Chemical

Georgia: Athens—Welding Gas Products; Atlanta, Macon—Welding Supply & Service; Augusta—Marks Oxygen; Columbus—Williams Welding Supplies; Gainesville—Welding Gas Products

Idaho: Boise—Gate City Steel

Illinois: Chicago, Moline, Rockford—Machinery & Welder

Indiana: Evansville—Drillmaster Supply; Ft. Wayne, Indianapolis—Sutton-Garten; South Bend—Perry Welding Sales & Service

Iowa: Des Moines—Machinery & Welder

Kansas: Wichita—Standard Products

Kentucky: Louisville—Reliable Welding; Paducah—Henry A. Petter Supply

Louisiana: Alexandria, Shreveport—Hughes Oxygen; New Orleans—Industrial Air Products of the South

Maine: South Portland—Portland Welding Supply

Maryland: Baltimore—Arcway Equipment

Massachusetts: Boston—New England G-E Welding Sales Division

Michigan: Detroit, Saginaw—Welding Sales & Engineering; Grand Rapids—Miller Welding Supply

Minnesota: Duluth—W.P.&R.S. Mars; St. Paul—Production Materials

Mississippi: Greenwood—Delta Oxygen Co.; Jackson—Jackson Welding & Supply

Missouri: Kansas City—Hohenschild Welders Supply; St. Louis—Machinery & Welder

Montana: Billings—Valley Welders Supply; Billings, Bozeman, Cut Bank, Glasgow, Great Falls, Havre, Kalispell, Miles City, Shelby, Sidney, Whitefish—Valley Motor Supply; Butte, Great Falls—Montana Hardware

Nebraska: Lincoln—Lincoln Welding & Supply; Omaha—Baum Iron

New Hampshire: Manchester, Nashua—MacLeod Co.

New Jersey: Elizabeth—Interstate Welding Supply

New Mexico: Albuquerque—Industrial Supply Co.; Hobbs—Western Oxygen; Las Cruces, Silver City—Car Parts Depot, Inc.

NEW G-E 295-amp a-c welder provides big-welder advantages at a small-welder price—only $237**

General Electric's new *295-amp* a-c welder brings you a versatile intermediate rating for: repair work and light production in job shops; industrial maintenance; tack welding and many other general-purpose jobs. It offers many benefits you would ordinarily expect only from a heavy-duty unit:

75 OPEN-CIRCUIT VOLTS—means quick starts, arc stability, and use even with "tough" electrodes like stainless-steel and low-hydrogen.

MOVING-COIL DESIGN—provides pinpoint accuracy in current settings and resettings. Settings can be made in an infinite number of steps over a wide current range.

SPECIAL RUBBER COIL MOUNTING—reduces friction, wear; makes turning of current lever almost effortless.

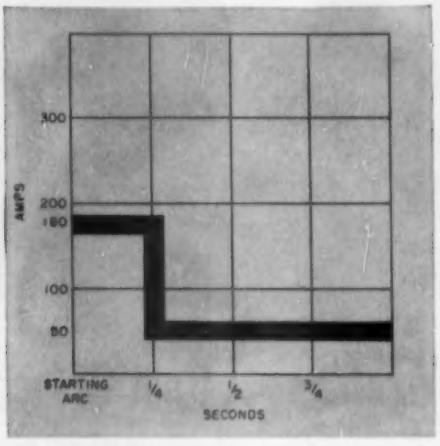
UNIVERSAL BOLT-TYPE TERMINALS located at the base to eliminate nuisance and hazards of dangling leads.

CONVENIENT RANGE SWITCH permits quick moves from high to low settings without unplugging leads.

For details, ask your G-E welding distributor for bulletin GEC-1305. General Electric Co., Schenectady, N. Y.

712-1

EACH SIDE COVER LIFTS OFF easily, with removal of only 3 screws. And no parts are attached. Simple inside construction can be serviced quickly.



AUTOMATIC HOT-START provides an extra surge of current when electrode touches the work. Arc striking is instant; sticking is reduced. Result: welding speed is increased and weld quality improved.

WIDE CURRENT RANGE spans 25 to 295 amps. Permits wide application. The low end of the range is expanded for fine accuracy.

***Mfrs. suggested resale price. Slight additional charge for freight west of Mississippi and Florida.*

GENERAL ELECTRIC

his convenient location means fast service

New York: Buffalo—Welding Equipment Sales; New York City—Weld-Arc Sales and Supplies; Syracuse—Welding Engineering & Equipment

North Carolina: Charlotte—Dixie Gases; Gastonia—Gastonia Motor Parts

North Dakota: Bismarck, Fargo—Acme Welding Supply

Ohio: Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield—Burdett Oxygen; Toledo—Odland Iron Works; Youngstown—Arcway Equipment Co.

Oklahoma: Oklahoma City—Hooper Supply; Tulsa—G-E Welding Sales Division

Oregon: Eugene, Portland—J. E. Haseltine; Medford, Portland—Industrial Air Products

Pennsylvania: Allentown, Philadelphia, Pittsburgh, York—Arcway Equipment

South Carolina: Columbia, Greenville—Welding Gas Products

South Dakota: Deadwood—Hendrie & Bolthoff; Lemmon—Valley Motor Supply Co.

Tennessee: Chattanooga, Knoxville, Nashville—Welding Gas Products; Memphis—Delta Oxygen

Texas: Abilene—M&M Welding Supply; Alice, Corpus Christi—Crane Welding Supply; Alpine, El Paso, Marfa, Pecos—Car Parts Depot; Amarillo—Welding Equipment & Supply; Beaumont—Beaumont Oxygen; Brownsville, Harlingen—Acetylene Oxygen; Dallas—Hill Equipment & Supply; Houston—G-E Welding Sales Division; Lubbock—Welders Supply of Lubbock; Midland—West Texas Welders Supply; Odessa, Pecos—Western Oxygen; Orange—Marine & Petroleum Supply; Pecos—Welding Supply Co.; Plainview—Plains Welding Supply; San Angelo—Southwestern Welding Supply; Texarkana—Hughes Oxygen; Wichita Falls—McGinnis Welding Supply

Utah: Salt Lake City—The Gallagher Co.

Washington: Seattle, Spokane—J. E. Haseltine; Seattle, Spokane, Yakima—Industrial Air Products

West Virginia: Bluefield—Bluefield Supply; Charleston—Virginian Electric; Huntington, Logan—Logan Hardware & Supply

Wisconsin: Milwaukee—Machinery & Welder

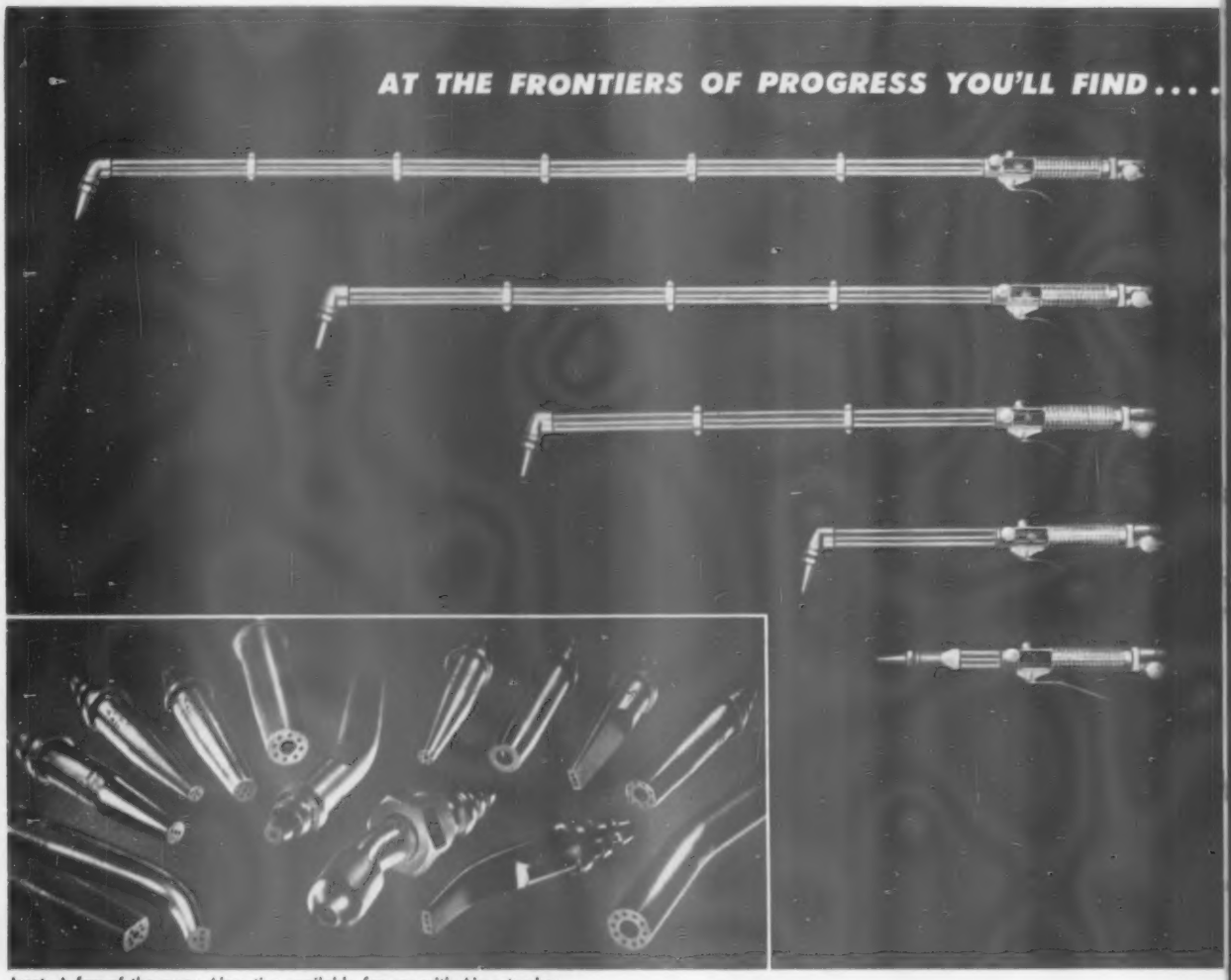
Wyoming: Cody, Lovell—Valley Motor Supply Co.

Alaska: Anchorage—Northern Supply

Canada: Toronto—Canadian G.E.

Guam: Agana—Industrial Air Products Div. of Island Equipment Co.

Hawaii: Honolulu—American Factors, Ltd.



Inset: A few of the many Airco tips available for use with Airco torches.

Airco Cutting Torches...from 13 inches to 6 feet in length!

The Airco 9000 series hand cutting torches are designed to make short work of jobs in scrap cutting, rivet washing and general maintenance.

Here's flexibility at its finest. Torches range from the 13-inch length for working in confined areas to the 72-inch length for keeping heat and fumes at a distance and include the standard 21-inch model. Torch heads are available with 45°, 75°, 90° and straight heads—your choice of monel or bronze.

An extremely wide selection of cutting tips, (over 25), make them adaptable for cutting metal thicknesses from sheet metal up to 12″ steel. Tips are available for cutting with acetylene, propane, or natural gas.

Companion accessories include the Airco Flash Circle Burner which is adjustable to cut circles 2½″ to 17″ in diameter. This unit can also be used with all cutting attachments and machine cutting torches.

See your Airco representative or Authorized Airco Dealer for detailed information and assistance —or—write Airco direct. Request Catalog 818.

AIRCO®

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company

Represented internationally by
Air Company International

Foreign Subsidiaries:
Air Reduction Canada Limited
Cuban Air Products Corporation

Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO—industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO**—carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO**—medical gases and hospital equipment • **NATIONAL CARBIDE**—pipeline acetylene and calcium carbide • **COLTON**—polyvinyl-acetates,—alcohols, and other synthetic resins.

AN AIR REDUCTION PRODUCT

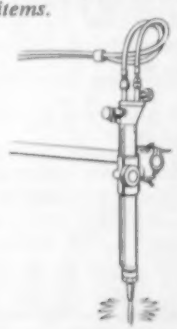
AIRCO items for flame cutting

The Airco 3000 Series Cutting Torches have the same rugged design features as the 9000 Series (shown at left). The principal difference is that the high-pressure oxygen control mechanism is designed so the cutting oxygen can be eased on gradually. This is particularly helpful in hole piercing, rivet washing, or rivet and stay bolt cutting.

The 3000 Series is also suitable for general purpose cutting of steels ranging from thin gauge to 12" thicknesses.

Airco two-hose and three-hose machine cutting torches are designed for use with standard Airco tips. The two-hose torches are for light and medium machine gas cutting primarily with Airco portable gas cutting machines like the Radiagraphs and Monographs.

The three-hose torches are for use with large Airco shape cutting machines such as the Duograph, Oxygraph, and Travograph. *Write for literature on these items.*



WELDING SHOW

VISIT BOOTH 254

A-c welder

A NEW general purpose a-c welder, for job shops and light industrial applications, covers a current range of 25 to 295 amp. It is said the new low-priced welder is ideal for maintenance work, tack welding at high currents and steady welding at moderate currents. The welder provides a 50 per cent duty cycle in the normal welding range of 200 amp with somewhat lower duty cycles when higher settings are used.

The manufacturer says a low range open circuit voltage of 75 volts provides easier starting and facilitates use of low-hydrogen and stainless-steel electrodes. Welder utilizes the moving primary coil design. *General Electric Co.*

Circle No. 65.

* * *

Soldering handpiece

HEAT blocking fins of an improved "Standard" handpiece for use with "Glo-Melt" resistance soldering power units have been redesigned to virtually eliminate transfer of heat to the handle from the working tip, claims the manufacturer.

It weighs 5 oz, is 8 in. overall and takes ¼ in. soldering tips. Supplied with No. 10 cable, 5 ft long, the tool is recommended for use with No. 105-B2 500 watt power unit. *Wassco Electric Products Corp.*

Circle No. 66.

* * *

Grinder

"NEECO-2-Twenty" is a 20-in. diameter double-disc machine which is said to operate at a perimeter speed of more than 18,000 fpm. It is powered with a 10-hp motor, which can handle the heaviest material removal loads without reducing disc speed. It is direct driven and supplied in 220 or 440 volts, 60 cycle. *New Era Engineering Co.*

Circle No. 67.

* * *

Soapstone pencil

Two-piece plastic soapstone pencil is adjustable and said to be sure locking. It is available with the dealer's name on it with lots of 6 doz or more. *Aladdin Rod & Flux Mfg. Co.*

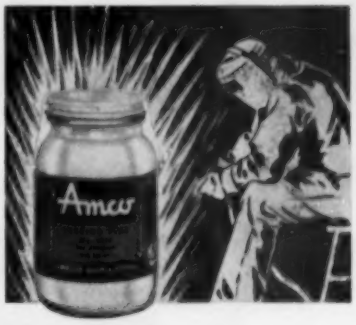
Circle No. 68.

Amco Fluxes . . . .

FIT YOUR JOB

Assure Welding & Brazing Success

. . . EVERY TIME



You are always sure of complete oxide removal and deep penetration when you use the proper Amco flux. Why? Because Amco chemical research and development make Amco fluxes right for the particular job. Whether you're working with ordinary metals, stainless steel, aluminum, cast iron or steel . . . there's an Amco flux to assure perfect bonding.

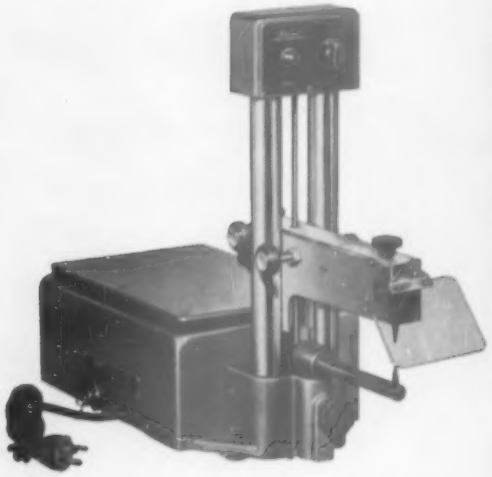
• Consult us on all your fluxing problems •

Distributor inquiries invited

American Solder & Flux Company

Flux Manufacturers Since 1910

19th & Willard Streets
PHILADELPHIA 40, PA.



WELDMATIC
Model 1015

TWEEZER-TYPE
HAND-PIECE

A major advance in precision metal joining

STORED-ENERGY WELDING SPEEDS PRECISION ASSEMBLY

NEW METHOD

Welded electronic components and precision instruments (resistors, potentiometers, capacitors, transducers, etc.) show superior performance with lower production costs. All metals and most combinations joined in many shapes and thickness ratios. Milli-second weld-time permits precision welding of copper, silver, and other "difficult" materials.

STORED-ENERGY PRINCIPLE

Unitek Weldmatic equipment utilizes capacitor-discharge to make precision resistance welds. Energy stored is instantly adjustable over a very wide range to accommodate wires 0.0003 through 0.040 inch diameter and sheet metal 0.00005 to 0.020.

WELDMATIC FEATURES

Simple installation, rapid setup, versatility, easy operation, and low maintenance make the Model 1015 best for electronics assembly. Untrained operators make uniform, high-strength welds with no discoloration or deformation. Other models available for special jobs.

Write for descriptive brochure.

Unitek WELDMATIC

UNITEK CORPORATION

263 North Halstead
Pasadena 8, California

Welding presses

COMPACT low-tonnage inverted mechanical presses designed for a variety of spot and projection resistance welding operations are made in a line of standard 32, 42 and 60-in. models, each having adjustable strokes of 5, 6 *and* 8-*in.*

These mechanical presses are rated at about 2-ton capacity. They have large upper and power platen areas that extend their application into other production operations, according to the manufacturer. They operate at a maximum of 2,200 strokes per hour.

Both upper and lower platens have spaced tapped holes which permit quick changeover from one electrode and fixture or die arrangement to another for small production operations.

The presses feature a self-contained mechanical drive unit called a mechanical knee. This unit is mounted in the base and raises and lowers the lower platen through a double scotch yoke mechanism driven by a 2-hp motor, clutch, brake and double-end worm gear speed reducer arrangement. The clutch and brake are combined in a unit that stops the platen in the up or down position while the motor and flywheel run at constant speed. *Expert Welding Machine Div.*

Circle No. 69.

* * *

Cover plates

PLASTIC clear cover plates for welding helmets are available in sizes 2 by 4⅛ in., 2 by 4 3/16 in. and 2 by 4¼ in. *The Eastern Safety Equipment Co.*

Circle No. 70.

For more information use card on page 99

STAINLESS STEEL

...fights corrosion...solves many piping problems

● Stainless steel piping, using TUBE-TURN* Stainless Steel Welding Fittings, can provide long, safe service where corrosive gases or fluids are handled. Likewise, stainless steel systems are superior where temperature extremes are encountered, for handling dangerous materials safely, for preventing contamination.

Tube Turns offers a *complete line* of Stainless Steel Welding Fittings in three analyses: AISI Type 304, Type 347, and Type 316; and in four schedules: 5S and 10S (thin wall), and 40S and 80S (heavy wall). For the *right* stainless steel welding fittings, and for help in proper application, get in touch with your Tube Turns' Distributor. You'll find one in every principal city.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A. They meet all U.S. piping code specifications

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Denver • Los Angeles San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

*"tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

STAINLESS DATA

How you get *extra service* from TUBE-TURN* Stainless Steel Welding Fittings

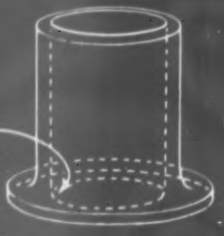
EXTRA-VALUE FEATURES AT NO EXTRA COST

UNIFORM WALL ASSURES UNIFORM STRENGTH

All TUBE-TURN Welding Elbows meet ASA B16.9 and MSS-SP43 Standards on minimum wall thickness of 87½% of nominal thickness — particularly important on thin wall welding elbows. Many elbows on the market are as much as 30% to 40% below nominal thickness at this point of greatest wear. Wall thickness is likewise uniform on the inside radius — no "bunching up" of metal.

MATCHES PIPE BURSTING STRENGTH

Welding Tees are adequately reinforced. Along with other TUBE-TURN Welding Fittings their strength matches the calculated bursting strength of the pipe.



NO CORROSION POCKETS

TUBE-TURN Lap Joint Stub Ends have a square inside corner (which eliminates a "corrosion pocket") and a proper fillet radius (which assures strength under flexing and vibration).

CHECK THESE FEATURES

Only TUBE TURNS offers them all

- **Fittings meet standard chemistry specifications**
- **Minimum wall thickness of elbows 87½% of nominal**
- **Fittings meet minimum calculated bursting pressure of matching pipe**
- **Qualified welders and procedures used where welding is required**
- **Each fitting properly solution heat treated**
- **Each fitting passivated**
- **Other special grades of stainless steel, and all other alloys available**

All these extra value features available to you at no extra cost.

MEET ALL CODES

TUBE-TURN Stainless Steel Welding Fittings meet all specifications: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); and MSS SP25 (marking procedure).

IMPORTANT DATA...

TUBE TURNS, Dept. N-2
224 East Broadway, Louisville 1, Kentucky
Please send STAINLESS STEEL "WHY AND WHERE" book.

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

DISTRICT OFFICES

New York	Los Angeles
Philadelphia	San Francisco
Pittsburgh	Seattle
Cleveland	Atlanta
Chicago	Tulsa
Detroit	Houston
Denver	Dallas

Midland, Texas

* "tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

Sander-grinder

DESIGNED to both sand and grind, this unit has a high-powered universal motor, yet weighs only 14 lb. Lubricant-sealed ball bearings are used throughout and heat-treated spiral bevel gears provide even flow of power. Replaceable steel wear ring protects front of main housing. Inspection is simplified by removable steel inspection plate. Interchangeable heads permit work on various materials. Voltage is standard 115 or 220 volts, but 125 or 240 volts can be had on special order. *The Black & Decker Mfg. Co.*

Circle No. 71.

* * *

Underwater electrodes

TWO electrodes ideal for underwater work are "UC" for cutting and "UW" for welding. "UC" is steel tube 14 in. long with 5/16 in. OD and 0.112 ID with extruded flux waterproof coating. Electrode is easy to use and not subject to breakage, can cut metals on land not readily cut by usual methods, it is claimed. "UW" is all steel with extruded and waterproof coating and is said to have stable arc even at great depths. Extruded coating prevents excessive clouding. "UC" is available in 15/16-in. size only, "UW" in ⅛, 5/32, and 3/16 in. *Pacific Welding Alloys Mfg. Co.*

Circle No. 72.

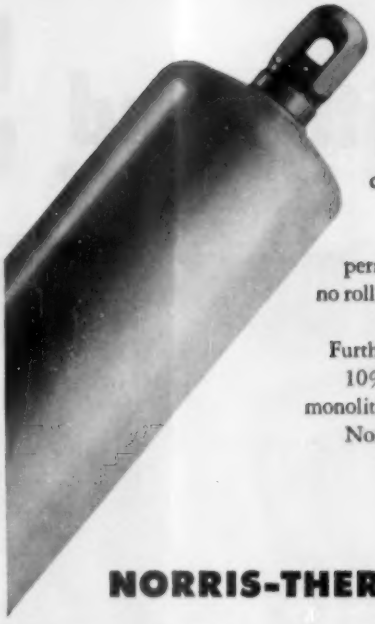
* * *

High frequency unit

A HIGH frequency unit for induction and dielectric heating can be used in the laboratory to determine the most effective applications, then transferred to full or part time duty on the production line.

Applications include brazing, soldering, hardening, annealing and melting of metals. The 5-kw dielectric unit can be run continuously at a frequency of 85 mg. *Radio Frequency Co.*

Circle No. 73.



saves you money

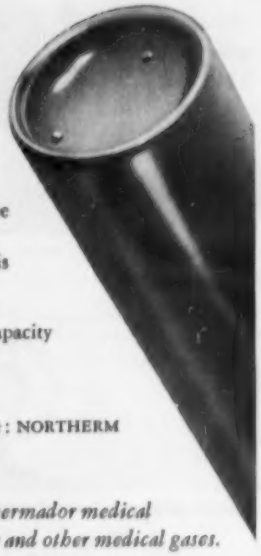
Norris-Thermador deep-drawn cylinders are curled under to form a heavy-duty built-in rolling surface that is even, strong, and permanent. *You save* because there is no rolling ring to lose or dent. Cylinders stand together evenly in transit. Further economies: cylinders are up to 10% *lighter* and fill faster than other monolithic filler type cylinders. And with Norris-Thermador's vast plant in the deep-water Port of Los Angeles, *you save* on overland freight.

NORRIS-THERMADOR

acetylene cylinders

precision-made

An exclusive and extremely accurate cold-draw process keeps shell weight to a constant thickness – with maximum thickness and strength in the cylinder shoulders. Excess weight is eliminated. *In addition, all welding is X-ray controlled.* Norris-Thermador cylinders meet or exceed ICC specification 8. (Cylinders are also made to Canadian Board of Transport Specifications. A disinterested inspection agency is available as required for these cylinders.)



Acetylene Cylinders from 10 to 300 cubic foot capacity

early shipment

Write or wire for specifications on all sizes. Cable : NORTHERM

Ask about precision-made Norris-Thermador medical cylinders for oxygen, nitrous oxide and other medical gases.

NORRIS-THERMADOR CORPORATION

5215 South Boyle Avenue, Los Angeles 58, California

Please send me illustrated cylinder specification sheets.

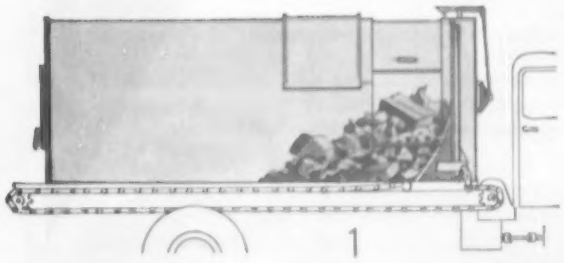
Name_____

Address_____

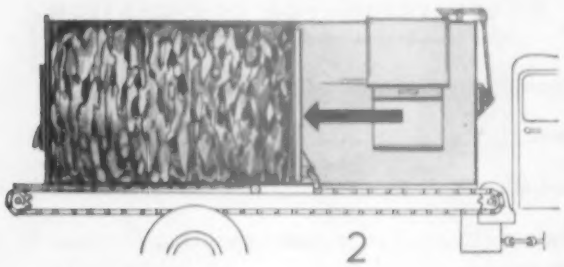
City_____ Zone____ State_____

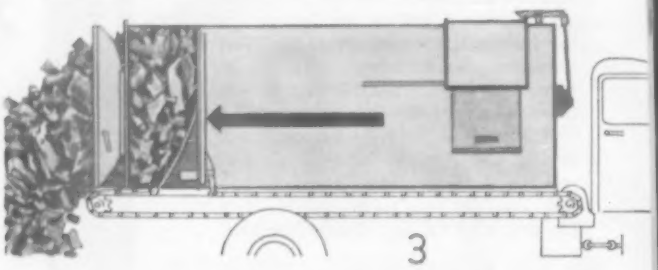
WE-455 3-954

Welds withstand 50,000



Here's the Pak-Mor refuse collection unit . . . welded throughout with A. O. Smith SW-85 electrodes. Front panel opens for loading. Packer plate not only compresses the load but also serves to discharge *the complete load* through the rear hatch. At present, Pak-Mor units are being used in 44 states, Washington, D.C., 602 communities across the nation and in these following foreign countries: Alaska, Canada, Colombia, Hawaii, Japan, Mexico, Panama Canal Zone and Venezuela.





lbs. force . . . . all day, every day. . . . without failure

They're made with A. O. Smith SW-85 electrodes . . . serve on ingenious Pak-Mor refuse collection units

A. O. Smith SW-85 electrodes are used *exclusively* in the building of unique all-welded Pak-Mor refuse collection units. Welds must *continuously* withstand a force of 50,000 lbs. exerted by a heavy-duty packer plate which travels the full length of the Pak-Mor body . . . compresses the load towards the rear hatch.

The builders of Pak-Mor selected SW-85 electrodes because of high tensile strength and durability. They are also pleased with easy handling in all positions — vertical, horizontal or flat. What's more, the SW-85 scores high with welders . . . proves its versatility in clean-up as well as production. It's readily adaptable to both a-c and d-c welding.

Get complete details from your A. O. Smith distributor. Or, if you prefer, write direct. A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wisconsin.

The man from A. O. Smith . . .

Grant Annable introduced Pak-Mor management to the SW-85 electrode. Like all A. O. Smith welding salesmen, Grant is always ready *and able* to help solve welding problems.

Everything for welding is yours from A. O. Smith!

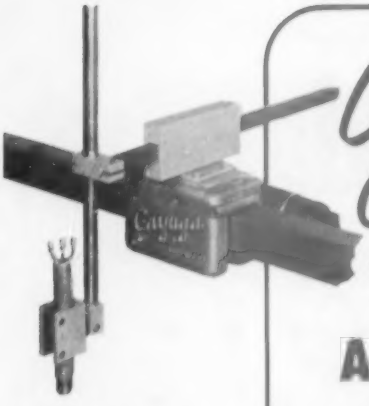
Welding is now *(and always has been)* our full-time business. Our record dates from the pioneering of the first truly practical welding electrode. We offer you America's top line of electrodes . . . welder-proved equipment and accessories . . . everything from a-c and d-c welding machines to helmets and tools.

Through research . . . a better way

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1, WIS.



Look to Cayuga for the best in

AUTOMATIC WELDING EQUIPMENT

SEAMER
A complete self contained portable unit, 5' - 20' long.

POSITIONER
100 to 25,000 lb. capacity 135° tilt current collectors; limit switches.

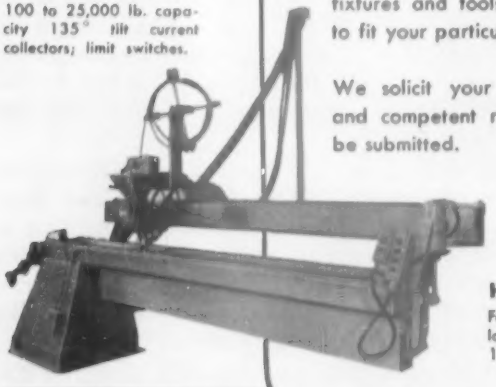
Cayuga builds a **complete** line of standard automatic welding equipment. Whether you need a single unit or a complete fabrication line, come to Cayuga.

We design, build and sequence all phases of the handling and welding operations, both mechanical and electrical. Automatic techniques, special fixtures and tools will be developed to fit your particular needs.

We solicit your inquiries. Qualified and competent recommendations will be submitted.

Booth #267

WELDING SHOW



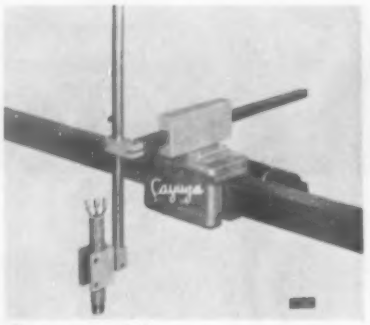
HORN JIG
For cylinders or rectangular tanks from 3' - 20' long, 1' to 20' diameter.

- HORN JIGS
- TRAVEL CARRIAGES
- TURNING ROLLS
- TURN TABLES
- WIRE REELS
- PEDESTALS
- POSITIONERS
- BEAMS

Cayuga

- DESIGNERS
- BUILDERS
- CONSULTANTS

MACHINE & FABRICATING CO., INC.
Depew - Buffalo, New York



Seam welder

PORTABLE seam welder, for welding seams from 5 to 20 ft long, is a self-contained unit with its own rail supported by either tripods or magnetic clamps.

It is said to be easily handled by one man and is designed to take the welder to the work piece, eliminating set-up time. It can be used in large plants or small job-shops and it provides a 15 to 1 speed range. *Cayuga Machine and Fabricating Co., Inc.*

Circle No. 74.

* * *

Lenses

50 mm lenses are for welding and burning goggles. These lenses are said to be safe because of their visibility and resistance to impact. 0.050 thickness is standard. *The Eastern Safety Equipment Co.*

Circle No. 75.

* * *

Wire machine

FAST, accurate and economical wire straightening and cutting is made possible by the features of "2-C" machine, according to the manufacturer. Two models are available: No. 2-C3 for wire from 1/16 in. to 3/16 in. and No. 2-C4 for wire from 3/32 in. to ¼ in. *Lewis Machine Co.*

Circle No. 76.

* * *

Leak detector

"LEAK-Tec" is specifically designed for detection of leaks. It is said to spread over surfaces and create a growing cluster of live bubbles wherever a leak occurs.

It is used for detecting leaks in gas lines, installation work, transmission lines, transformers, air-conditioning equipment, industrial, maintenance work, apparatus testing, aircraft, castings, tanks, rubber products, air brakes, etc. *American Gas & Chemicals, Inc.*

Circle No. 77.

For more information use card on page 99

you can be one of the lucky weldors to get a "GOLD ROD"

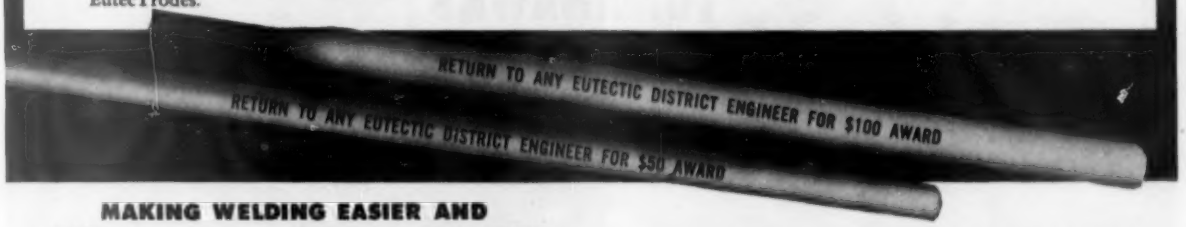
. . . share $300 in awards

COMMEMORATING EUTECTIC'S 15TH YEAR OF "GOLDEN" SAVINGS FOR AMERICAN INDUSTRY AND FIRST 50 YEARS OF RESEARCH

There's no contest to enter! Nothing to write! Between April 1st and November 1st, 1955, five weldors will find a special "Gold" rod or electrode in their shipments of new, 1955 Eutectic "Low Temperature Welding Alloys." One represents the 1 billionth "rod" produced by Eutectic during its first fifteen years. The weldor who returns it to his Eutectic District Engineer will receive a $100 award.

The four other "Gold" rods symbolize Eutectic's 15th Anniversary and first 50 years of research. The weldors who return these will each receive a $50 award.

It's as simple as that. Just be on the watch for a "Gold" rod in your shipments of EutecRods and EutecTrodes.



MAKING WELDING EASIER AND MORE PROFITABLE THROUGH RESEARCH

15 years of relentless research have helped Eutectic "Low Temperature Welding Alloys" gain the preference of a rapidly increasing number of weldors in 87,000 American industries. Each year, Eutectic research has introduced new products for "Better, Faster, Cheaper" welding. Now, a new "15th Anniversary" laboratory in Flushing, N. Y., and additional research centers in Europe will assure continued advances in the fight against an important cause of weld failure: HIGH HEAT!

To keep pace with the increasing demand for Eutectic "Low Temperature Welding Alloys," a 1,000-rod-per-minute extrusion press and baking oven has been installed in Eutectic's Flushing plant. As on all five Eutectic production lines, the speed of this equipment is secondary to its ability to meet the rigid quality controls that maintain every Eutectic product at the most exacting specifications.

EUTECTIC DISTRICT ENGINEERS PROVIDE UNIQUE "SHOP-TO-SHOP" SERVICE

The more than 350 District Engineers show . . . so weldors can know . . . how to get every advantage of "Low Heat Input" metal joining. On every call, the Eutectic District Engineer brings in his "kit" the full resources of Eutectic research, new alloy developments, and the vast experience that he and all his fellow District Engineers have amassed over the years.

One of the many products introduced by Eutectic District Engineers during 1954 was EutecTrode 1850 — the all-purpose, highest tensile copper alloy for joining and overlaying dissimilar metals. During 1955, they'll introduce other and equally superior new "Low Temp" EutecRods and "Low Amp" EutecTrodes. Watch for these new sources of savings.

50th YEAR OF WELDGINEERING

J. P. H. Wasserman first saw the phenomenon of surface alloying and adapted it into a new welding process in 1905. Rene D. Wasserman perfected the process, and, in 1940, founded Eutectic Welding Alloys Corporation, in New York. Eutectic is now the inventor, patentee and sole manufacturer of Eutectic "Low Temperature Welding Alloys"® that minimize or completely eliminate the dangers of high heat fusion welding — warping, distortion, stress and embrittlement of base metals. Today, after 50 years of pioneering and Weldgineering, Eutectic is your guarantee of a profitable solution for most welding problems . . . your one source of "Low Heat Input" metal joining techniques.

J. P. H. Wasserman

R. D. Wasserman

FREE **15th ANNIVERSARY DIRECTOROD GUIDE**

There is no substitute for Eutectic "Low Temperature Welding Alloys" . . . no "produced-for-a-price" welding material can ever provide Eutectic results. To help you select the EutecRod or EutecTrode that will give you the largest savings per job, write today for your free copy of the new, 32-page 15th Anniversary Directo-Rod Guide to "Better, Faster, Chesper Welding." *Just ask for TIS 1340.*

EUTECTIC WELDING ALLOYS CORP.

172nd Street and Northern Boulevard, Flushing 58, N. Y.

WORLD-WIDE WELDGINEERING TEAM

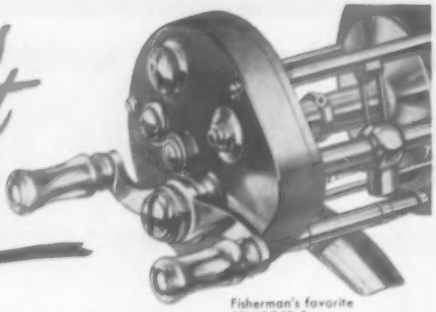
With Associated Laboratories in

Lausanne, Switzerland
London, England

EUTECTIC

Paris, France
Frankfort, Germany

Quality is a big part of skill



Fisherman's favorite
PFLUEGER Supreme

Thousands have demonstrated willingness to pay what it costs for this quality...

Model H Cone and Chisel
one of 27 models

ATLAS TOMAHAWKS

No question about it — good tools produce better results. The name Atlas is standard in shops where weld cleaning is taken seriously. Workers like the balance and "feel" of Atlas Tomahawks and take pride in the better work they produce. You'll like the way they wear, too.

ATLAS
WELDING ACCESSORIES COMPANY
FOX & LEWISTON AVENUE
FERNDALE 20, DETROIT, MICHIGAN

Ask your welding supply dealer to show you the Atlas line

ASK YOUR WELDING SUPPLY DEALER

A good weld cleaning job performed with good professional tools will better reveal the quality of the weld

You Can't Beat ATLAS Quality

Proving rings

TURNBUCKLE-type proving ring with 0 to 300 lb capacity can read tensile or compression loads. It also can be used to apply a tensile load by simply taking up on the turnbuckle forks at opposite sides.

It is furnished with a dial graduated in angular degrees, which is said to give maximum accuracy. Translation of readings into pounds is done on a separate calibration reference chart. *W. C. Dillon & Co.*

Circle No. 78.

* * *

Dock shield

METAL and canvas collapsible door hood is said to make loading dock draft free and weatherproof. "Loading dock shield" was designed to conform to U. S. Pure Food Regulations on constant cold temperature maintenance. Shield fits standard size rail or truck dock door. Optional bottom cover gives full four-side protection. High tension springs hold shield taut. When not in use, shield folds flat. Shield is fire, water and mildew resistant and is UL approved. *Frommelt Industries.*

Circle No. 79.

* * *

Welding presses

A NEW type resistance welding press is adaptable not only to the automotive field, but also to a broad variety of sheet metal fabrication and end product manufacture in almost every industry, according to the manufacturer.

This welder is said to lend itself to a variety of complete tooling changes to meet specific metal fabricating requirements. The four post mechanical welding press will accept any welding fixtures necessary to perform the fabrication, and it is also engineered for removal of the multiple point welding fixture. *Link Welder Corp.*

Circle No. 80.

Now the new ready-to-use "132" Inconel Electrode

Helps you weld Inconel and Incoloy...

Better – You can use the new "132" Inconel Electrodes right from the container to obtain X-ray quality corrosion resisting welds. And the weld deposit meets all approved specifications for Inconel.

Easier – You get a high rate of deposition, smooth bead contour, stable arc in all positions, and easy slag removal. Recommended for D.C. welding.

Faster – No rebake is needed. The new, durable flux coating and core wire of "132" Inconel Electrodes give strong, sound welds in the as-received condition.

Standard Sizes—Handy 14-inch lengths in 5 diameters: 5/64 and 3/32-inch (both center grip) . . . and 1/8, 5/32 and 3/16-inch (each end grip).

Your local Inco distributor has the new "132" Inconel Electrode in stock for you. See your classified telephone directory, or MacRae's, or Thomas' Register. Order a 5-lb. package today. You'll like the protective tubular container. It has asphalt lining, metal ends and moisture-resistant, reusable sealing tape.

INCO TRADE MARK **Welding Products**

Electrodes • Wires • Fluxes

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

See the new "132" Inconel Electrode demonstrated. Visit Inco exhibit, BOOTH 109, at the WELDING SHOW MUNICIPAL AUDITORIUM KANSAS CITY, MISSOURI, JUNE 8-10

SILVER BRAZING
ALLOYS and FLUX
TEAM UP TO
Save You Money!
More and more cost-conscious manufacturers are specifying GB Silver Solder and GB Flux! They have found that these two products, developed to work together, give them the best results on their low temperature brazing operations.

GB HELPS YOU CONTROL THESE COST FACTORS!

SPEED
HEATING
MATERIAL
LABOR
CLEANING
FIT-UP
PREPARATION

GB Silver Solders are available in six standard alloys—each developed to meet specific cost and production requirements. All are available in the most convenient form to meet your needs—wire coils or straight lengths, strips, sheets or formed pieces.

GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F

And, if you require a special Silver Solder, Goldsmith's Technical Service Division is ready to give you competent assistance—their recommendations will be backed by 80 years of experience in alloying and refining precious metals.

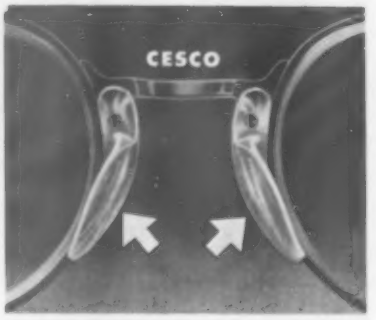
GB FLUXES

Produced under strict laboratory control, GB Fluxes are fully active, deep penetrating, stable and economical. While developed primarily for use with GB Silver Solders, they produce high quality joints with any good silver solder.

GB DATA BOOK

Here's down-to-earth information on the important phases of low temperature brazing. You can get a free copy from your GB Distributor—Write us and a copy will be forwarded to you.

GOLDSMITH BROS. SMELTING AND REFINING CO.
1304 W. 59th Street, Chicago 36, Illinois
Suppliers of Precious Metals to Industry Since 1867



Spectacle bridge

FLEXIBLE polyethylene bridge pads for welding goggles adapt themselves easily to contour of wearer's nose for perfect fit, is is claimed. Known as "No. F9P," these pads spread weight evenly and thus remove feeling eye protection is being worn. Pads are available separately or on new spectacle-type goggles. *Chicago Eye Shield Co.*

Circle No. 81.

* * *

Solder

SOLDER can be brushed on cold without a separate application of flux. Only a thin coating is needed. It can be used on copper, brass, steel, Monel, nickel, stainless steel, galvanized steel, etc. The solder is said to be excellent for use on autos, radios and refrigeration equipment. *Perma-Latem Welding Alloys, Inc.*

Circle No. 82.

* * *

Plastic caps

PLASTIC cap is designed for protection of gas cylinder valve outlets during shipping, handling and storage. The caps are said to assure protection against thread damage and keep dirt and moisture out of the outlet.

They are made of a vinyl rubber-like plastic and they hold by friction and suction. They can be readily removed by pulling back on the tab provided for that purpose. *S. S. White Plastics Division.*

Circle No. 83.

For more information use card on page 99

really NEW... ... FOR PORTABLE GRINDERS

"GRINDAWAY"* wheels with SAFETY RINGS which grind away

. . . they assure you of increased safety, because they reduce the danger of "bursting"

If you have ever been around when a grinding wheel "explodes", you know what can (and often does) happen . . . it's not only frightening, but can be very dangerous.

But now, we of Colonial, have, after many years of grinding wheel experience, developed the "GRINDAWAY" reinforced resinoid high speed wheel for portable grinding. This wheel not only offers a greatly *increased safety factor,* but in addition, is the same high quality wheel that Colonial has always manufactured.

The "exclusive" feature of this new wheel is the reinforced rings, which have a higher Tensile strength than steel . . . and, these rings are inserted right where the reinforcement is needed: in the actual grinding portion of the wheel . . . this is only made possible, because they abrade away as the wheel wears through them.

Colonial offers "GRINDAWAY" Safety Wheels in three types: straight, recessed, and flaring cup . . . all available *without any premium cost.*

Of course, Colonial continues to offer industry a complete line of regular Vitrified and Resinoid wheels for every grinding need, plus their personalized grinding wheel Engineering Service.

Write, wire or phone Colonial today regarding your grinding problems . . . You will receive prompt, courteous attention and worth-while advice.

*Patent applied for

FREE LITERATURE UPON REQUEST

NOTE: In testing laboratories GRINDAWAY wheels have been purposely cracked, and then run at speeds considerably higher than normal operating speeds "without bursting".

COLONIAL ABRASIVE PRODUCTS CO.
SIXTH AND HARRY STREETS
CONSHOHOCKEN PENNSYLVANIA

PHOSON-O PHOSON-6

These Two *United* Alloys

...for
All Your Copper and
Brass Joining!

Tubular Assemblies
Stampings
Screw Machine Parts
Electrical Connections
etc.

PHOSON-O
(No Silver!)

Industry's most popular alloy choice for brazing closely fitted copper and brass joints where exceptionally low temperature is not an important consideration.

Highly Efficient! Most Economical!

Use Phoson-O for brazing joints of consistently uniform clearances — quickly, safely, surely!

PHOSON-6 (6% Silver)

For really low temperature brazing and complete control of alloy flow . . . where maximum ductility and varying joint tolerances are key factors.

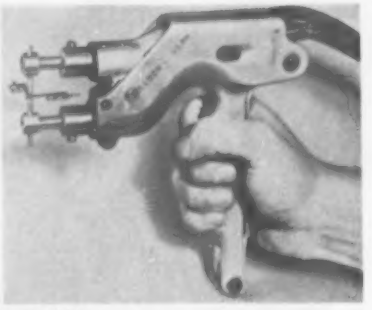
PHOSON-O (No Silver!) PHOSON-6 (6% Silver)

These Two Alloys For All Your Copper and Brass Joining!

Two Good Reasons Why PHOSON BRAZING ALLOYS Are Busier Than Any Brazing Alloys In The Country!

Wherever Metals Are Joined, Keep Them— Permanently United

UNITED WIRE
AND SUPPLY CORP.
Brazing Alloy Division
PROVIDENCE 7, R. I. • OFFICES IN PRINCIPAL CITIES
Send for special PHOSON folder NOW!



Welding gun

"TWEEZER-Weld Gun", portable welding gun, welds materials from 0.003 in. to the combined thickness of 0.074 in. A light weight aluminum unit, it is said to develop electrode pressures from 1 to 50 lb with a light hand squeeze pressure. Manufacturer claims spot welds can be made as fast as the operator can squeeze and release the trigger.

Unit is 8 by 8 in. and made from flexible copper, vinyl covered leads and is said to be ideal for "hard-to-get-at" places.

Accessories necessary to operation are either a condenser discharge power supply or standard a-c equipment including transformer, non-synchronous timer and heat control. *Federal Tool Engineering Co.*

Circle No. 84.

* * *

Electrode

"PHOS-TRODE" is heavy covered, shielded-arc electrode for metal-arc welding in all positions. It has a phosphor bronze Grade C (AWS-ASTM E Cu Sn C) core and patented covering containing special grain refining and deoxidizing ingredient. Phos-Trode" can be used for many joining and overlay applications due to spray-type arc action, low spatter loss, easy handling, dense deposit and smooth flow, manufacturer states. It is available in 50-lb cartons and in 3/32, 1/8, 5/32, 3/16, and 1/4-in. diameter sizes, and bare on 25-lb spools in 0.045, 1/16, 5/64, and 3/32-in. diameter sizes for Mig (metal inert-gas) welding. *Ampco Metal, Inc.*

Circle No. 85.

* * *

Aluminum solder

Low-temperature solder is for soldering aluminum to aluminum and to dissimilar metals with "585 Super" soldering flux. *Aladdin Rod & Flux Mfg. Co.*

Circle No. 86.

For more information use card on page 99

Puretung

Thoriated Tungsten

Zirtung

Keep these SYLVANIA rods on hand... and you're ready for any inert gas welding job

SKILL ALONE is not enough! For consistently sound welds and electrode economy as well, you need the right rod for the job. That is why Sylvania manufactures *three* top-quality tungsten rods . . . to meet the full range of conditions encountered in atomic hydrogen, helium and argon arc welding.

Each of these three Sylvania Tungsten Electrodes will maintain the uniform, stable arc you need for successful inert gas welding. And each of them will give you outstanding economy; minimum tungsten loss in the arc.

Sylvania Tungsten Electrodes come to you with chemically cleaned, etched surface . . . the standard finish for most applications. Other finishes available include centerless ground and black graphite coated.

Order Sylvania Tungsten Electrodes in handy packages of ten from your welding supplies distributor. For technical information, write to:

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N.Y.

In Canada:
Sylvania Electric (Canada) Ltd., University Tower Bldg. St. Catherine St., Montreal, P. Q.

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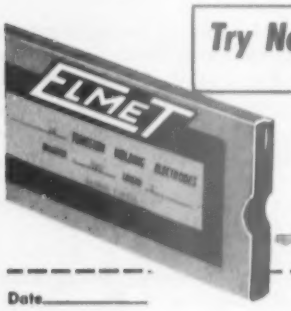
A NEW, *Improved* WELDING ELECTRODE by ELMET

—Pioneer Tungsten Producer

Here at last are pure and thoriated tungsten welding electrodes you can depend upon for uniformly superior performance. ELMET Efficiency Electrodes are manufactured by North American Philips, one of the pioneer tungsten producers with more than 20 years experience in this highly specialized field.

For purity, efficiency, reliability and perfect mechanical conditions, ELMET Tungsten Electrodes will meet your severest requirements. Their uniformity of properties, dimensions and characteristics prevent loss of time due to readjustments of equipment and voltage.

Rod diameters are held within specified diameters and limits of straightness, thus assuring good fit and uniform feed adjustment. Furnished in cleaned finish and centerless ground finish. Available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length. North American Philips Co., Inc., Elmet Division, Lewiston, Maine.



Try New ELMET Electrodes Now!
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Free Folder

Don't delay! Do it today! Send the coupon and get the facts about ELMET Efficiency Electrodes.

Distributor Inquiries Invited

Date_____

NORTH AMERICAN PHILIPS CO., INC.,
Box 1041A, Lewiston, Maine.

Please send me ☐ *Free Folder and*

☐ *Price on* _____ *Elmet Electrodes.*
(quantity, size, finish)

Name_____

Street_____

City_____ State_____

☐ *Send me your distributor proposal.*

NEW PRODUCT BRIEFS

Footswitch designed for use in normal and heavy duty switching, is recommended for operating industrial machinery, business machines, magnetic switches, photographic equipment, etc. *Vemaline Products Co.*
Circle No. 87.

* * *

"Straightaway" sound protectors are new type of device for preventing the effects of loud noise encountered in many occupations. They screen out loud, high-frequency noises, but voices are audible to the wearer. *American Optical Co.*
Circle No. 88

* * *

Short lengths of wire from 1 to 12 in. long and up to ⅛ in. in diameter are straightened and cut to size accurately and quickly by "No. 7" wire machine, states manufacturer. *The Lewis Machine Co.*
Circle No. 89.

* * *

Aluminum-pigmented strippable coating, "PV-845," provides protection for metal surfaces during both inside and short-term outside storage. Coating is applied by brush or spray and is available in 1, 5 and 55-gal drums. *Specialty Coatings, Inc.*
Circle No. 90.

* * *

Adjustable filter-lubricator gives protection to air cylinders and small pneumatic tools. Forty-micron element is said to remove particles as small as 0.0001 in. *Nu-Jett Products Corp.*
Circle No. 91.

* * *

Three high-temperature germanium diodes, "1N265," "1N266" and "1N267," designed for clip-in or solder-in application. *International Rectifier Corp.*
Circle No. 92.

* * *

Heavy-duty welded all-steel workbench, said to be capable of supporting 2,000 lb safely, was designed for mobility. Several sizes are available. Standard unit is 34 in. high, 41 in. long and 26 in. wide and weighs 325 lb. *Overbeke-Kain Co.*
Circle No. 93.

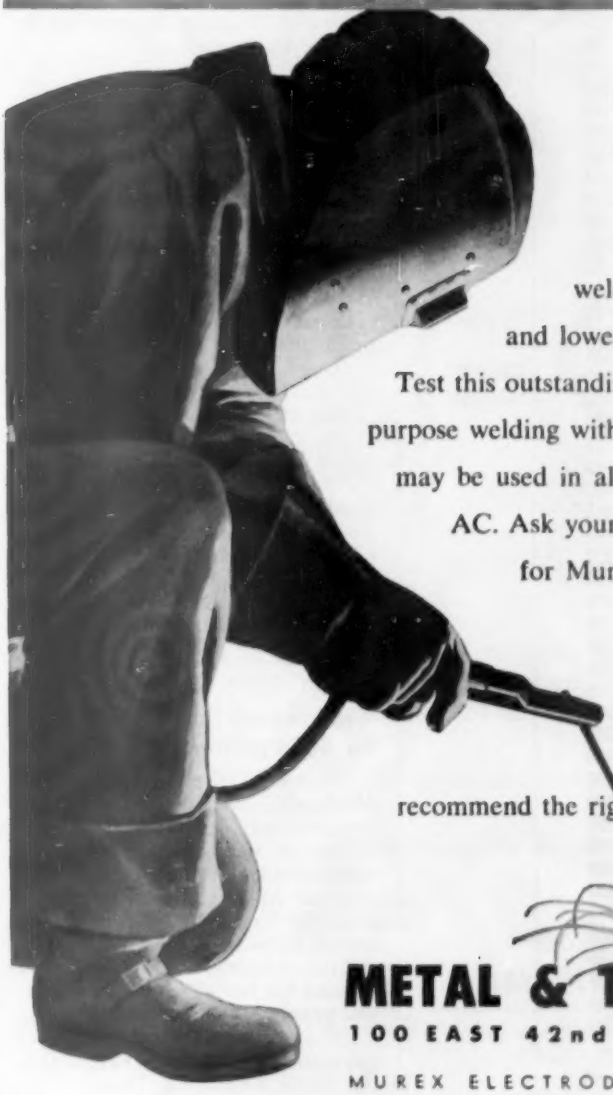
* * *

Semi-direct lift "Atkomatic" bronze solenoid valve is claimed suitable for use with air, gas, freon, and other media not harmful to bronze or stainless steel. Valve fits ½, ¾ and 1-in. pipe sizes. *Atkomatic Valve Co.*
Circle No. 94.

15 Good Reasons Why

GENEX M can improve your E-6012 welding

SMOOTH ARC	WIDE CURRENT RANGE	GOOD ROOT BEAD CONTOUR
STEADY ARC	OUTSTANDING ON AC	PLEASING SURFACE APPEARANCE
MINIMUM SPATTER	GOOD WETTING ACTION	EASY TO USE ON VERTICAL DOWN
EASY TO RE-STRIKE	EXCELLENT FILLET CONTOUR	GOOD ON LIGHT GAUGE
NO CHANGE AS ROD IS CONSUMED	WELL-SHAPED COVER BEADS	READILY BRIDGES GAPS



Right across the board—the characteristics of all Murex Genex M qualities add up to improved welding at lower cost because they mean greater operator appeal, higher weld quality, fewer rejects, speedier welding and lower cost.

Test this outstanding electrode yourself. Designed for general purpose welding with poor fit-up on all E-6012 applications, it may be used in all positions on DC straight polarity, or on AC. Ask your nearest M&T representative or distributor for Murex Genex M electrodes—You will like the way they handle, and be amazed at the results.

There is a Murex electrode for *every* welding use. Ask your M&T man to recommend the right electrode for your next job.

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NEWS . . . . . *from page 6*

grams of radioactive thulium metal or oxide, pressed into an aluminum capsule. The capsule is recessed into a small cylinder which rotates within an outer shield of lead. The entire unit is approximately 6 in. in diameter and seven in. long and weighs about 20 lb.

The AEC will not engage in the commercial production of the thulium or in the manufacture of the units. It is expected that private industry will be able to supply the potential market.

* * *

G-E welding services get new southwest building

The new building for General Electric's welding sales branch at Tulsa, Okla. includes offices, service and warehouse facilities. It will serve Colorado, Wyoming, Kansas, Arkansas and Oklahoma.

* * *

Carnegie Tech gets grant for three-year study

The Mechanical Engineering Department at Carnegie Institute of Technology was granted $19,341 from the Army Ordnance Corps to continue a three-year study on galling and friction of metals. The project is currently concerned with titanium, which holds the Army's interest because of its use in making aircraft and gun parts.

The Metals Research Laboratory at the same school also recently received a grant from the U.S. Air Force Development Center at Wright Field, Ohio, to investigate the influence of silicon on the mechanical properties of high-silicon-content steel. A silicon steel is highly desirable because silicon is a non-strategic metal and occurs abundantly in nature.

* * *

Wind tunnels fabricated for flight performance study

Fabrication of three wind tunnels, which will enable aeronautical engineers to study flight performances at air speeds well over five times the speed of sound, is progressing at the two Los Angeles plants of the Consolidated Western Steel Division of United States Steel Corp.

After completion, the tunnels will be used for testing aircraft, missiles, and missile engines at supersonic and hypersonic air speeds at the Arnold Engineering Development Center, U.S. Air Force, Tullahoma, Tenn.

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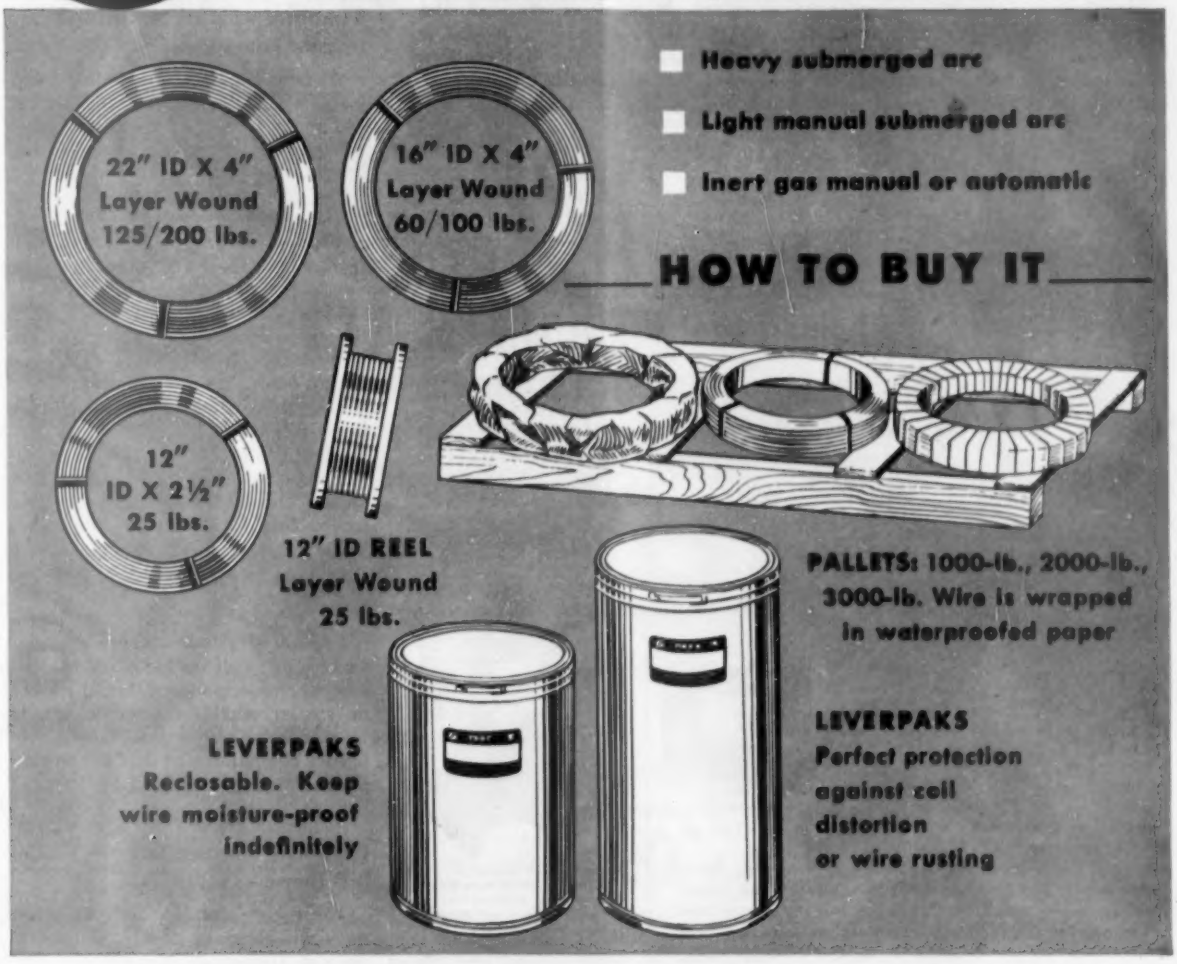
Page Welding Wire

PAGE CHECK-OFF

Check the welding wire you use:

- ☐ Heavy submerged arc
- ☐ Light manual submerged arc
- ☐ Inert gas manual or automatic


22" ID X 4" Layer Wound 125/200 lbs.
16" ID X 4" Layer Wound 60/100 lbs.
12" ID X 2½" 25 lbs.
12" ID REEL Layer Wound 25 lbs.
HOW TO BUY IT
PALLETS: 1000-lb., 2000-lb., 3000-lb. Wire is wrapped in waterproofed paper
LEVERPAKS Reclosable. Keep wire moisture-proof indefinitely
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CARBON STEEL • Any carbon from Armco (.025 max.) to high carbon (.90-1.10). All standard AISI analyses in between.

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5 weldors may share $300 in Eutectic celebration

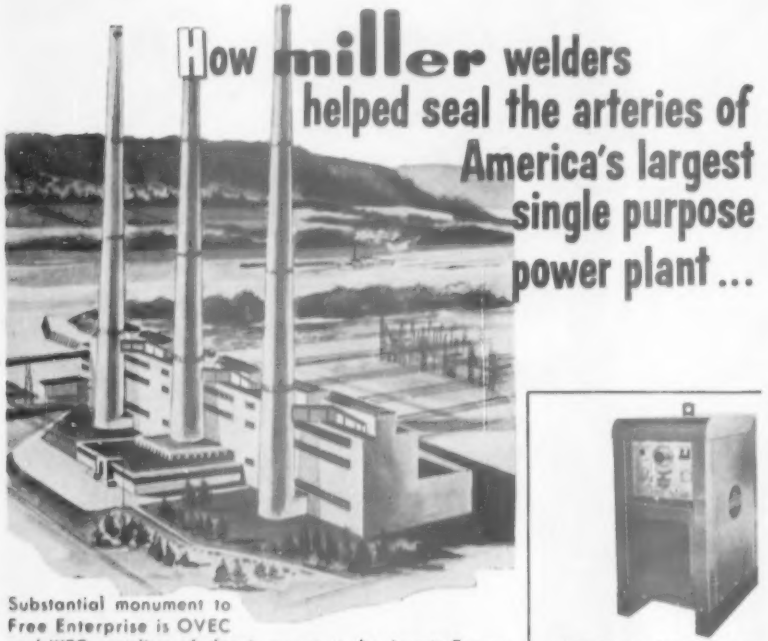
Five weldors who find special gold welding rods or electrodes in their shipments of new 1955 Eutectic welding alloys between now and Nov. 1 will share $300.

As part of its 15th anniversary celebration, Eutectic Welding Alloys Corp., Flushing, N.Y., will include five special gold rods in its regular shipments. The weldor receiving the rod, which represents the billionth rod or electrode produced, can win $100 by returning it to his local Eutectic district engineer. Other weldors returning their special rods can receive $50.

* * *

First Canadian shipment to U. S. by International Nickel

First shipment of approximately 450,000 lb of refined nickel was recently made by The International Nickel Co. of Canada, Ltd., to the United States government.



How miller welders helped seal the arteries of America's largest single purpose power plant...

Miller Selenium Rectifier d-c Arc Welder, in four wide-range models. For complete, concise, worthwhile information on these and other Miller Arc and Spot Welders, contact us today ... at no obligation, of course.

Substantial monument to Free Enterprise is OVEC and IKEC, suppliers of electric power to the Atomic Energy Commission's new uranium diffusion center in Pike County, Ohio.

Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation, agreed to supply electric power to this great new atomic production center . . . *15 billion kilowatt-hours annually.*

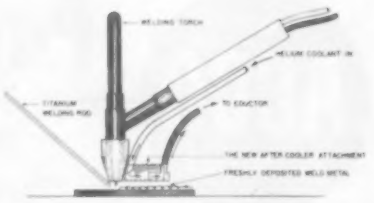
Two huge generating stations are being built: The Kyger Creek Plant at Cheshire, Ohio will have five generating units of 200,000 KW each; Madison, Indiana's Clifty Creek plant will produce 1,200,000 KW with its six big generators. Each of the eleven turbo-generating units will operate off a single boiler, with super-heated steam reaching 1,050 degrees Fahrenheit under 2,000 lbs. pressure per square inch! The high temperatures and reheat, which the sponsor companies have pioneered in their own right, will make these two plants among the most economical, most efficient generating stations in the country.

These same elements, however, make the fabrication of faultless high-pressure steam lines vital . . . and extremely difficult. To accomplish this extremely important task, pipe welding specialists equipped with the maximum of engineering skill utilized the Miller Selenium Rectifier d-c Arc Welder.

". . . . if it's Miller, you know it's the *finest!*"

miller ELECTRIC MANUFACTURING COMPANY, INC.
APPLETON, WISCONSIN

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal, P.Q.



Titanium welding simplified by new attachment

A new attachment for use with inert-gas-shielded welding torches and guns, developed by the welding laboratory of U.S. Naval Engineering Experiment Station is said to simplify the welding of titanium, according to the *EES News*.

The problem up to now has been trying to shield the titanium from the air during the welding process. This shielding is necessary because, when heated to high temperatures, the titanium takes on oxygen and nitrogen which cause defective welds. Other devices to shield the titanium have been ineffective.

The new attachment shields the titanium from the time it is deposited until it reaches the lowest temperature, 1200 F, at which the atmospheric gases can be effective. It does away with old, cumbersome arrangements and does not hurt the welding operation.

Especially good when a non-flat surface or small radius is needed, the new appliance is good for shielding no matter what the contour of the joint. Also, it allows joint tensile properties comparable to that of the base metal.

* * *

Forecasts maintenance bill increase in 1955

The nation's maintenance expenditures will increase by $1,000,000,000 in 1955, Howard F. McCullough, general manager of General Electric's Service Shops Dept., recently predicted. He made his prediction on the basis of a trend towards automation. As this trend increases and industrial plant electrification expands, maintenance must be made more efficient in order to increase output, quality and reduce product costs.

G-E has a five-step productive maintenance plan which advocates: (1) the gathering of complete equipment data through equipment inventory, (2) the determination of the extent of routine maintenance for industrial electrical systems, (3) establishment of a routine operating control system, (4) evaluation of the equipment for critical maintenance, and (5) establishment of a critical maintenance program.

TERRIFIC HEAT !

HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.

HARRIS 1908 50 1958 ANNIVERSARY

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CLEVELAND 2, OHIO

CONTOUR CUTTING

Doesn't have to be a hair pulling proposition!

Yeh, Joe won the contract all right . . . the whole ding-blasted works . . . miles and miles of pipe fabrication and some of the darndest shapes to cut you ever saw! Joe lost money on that job. Oh sure, he made a profit, but he could have made more — lots more — with the H & M Shape-Cutter and Beveler. Joe didn't know it but the H & M could have saved **90% of his time** on those contour cutting problems. With the H & M Shape-Cutter all you do is attach the desired cutting pattern to the machine . . . slip the machine over the pipe and snap in place . . . light the torch . . . give the hand crank a few turns . . . and the job is done — the maximum SPEED WITH ACCURACY. Joe had a few choice words for those reject welds too . . . the H & M certainly could have saved him a lot of fuss and bother. If you're in the same fix as Joe get all the details . . .

WRITE FOR THE FREE FOLDER
"MORE PROFIT DOLLARS IN PIPE FABRICATION"

H&M PIPE BEVELING MACHINE CO.

Trade Mark Reg. U.S. Pat. Off.

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NWSA zone meeting reaches new attendance record

The western zone meeting of the National Welding Supply Association set a new attendance record of 139 delegates in San Francisco, Feb. 10 and 11. Vice-President J. Gordon Duff, Gordon Duff, Inc., presided over the sessions.

Applications for membership were received from Bridgeport Brass Co., Bridgeport, Conn.; Benson & Zimmerman Co., Modesto, Calif.; Littrell Parts, Redding, Calif.; and McQuay Supply Co., Las Vegas, Nev.

President James N. Alcock, Saginaw Welding Supply Co., Saginaw, Mich., delivered a talk entitled, "Dig that Gold." Other speakers included: John R. Morrill, Gibson Welding Supplies, Inc., Spokane, Wash.; W. P. Shaughnessy, Addressograph - Multigraph Corp., Cleveland; Paul J. Leonard, Wagner Manufacturing Co., Inc., Jackson, Mo.; L. J. Weisgerber, K - W Distributing Co., Huntington Park, Calif.; A. G. Pond, A. G. Pond Co., San Jose, Calif.; Jack Payton, A&R Equipment Co., San Bernardino, Calif.; Harry Moore, Moore's Welding Supply, Sacramento, Calif.; C. W. Meisterlin, Soule Steel Co., San Francisco; William H. Smith, Department of Research and Analysis, Federated Employers of San Francisco, San Francisco; C. L. Breese, John Tillman & Co., Long Beach, Calif.; Frank Keene, Gordon Duff, Inc., Los Angeles; Hal Savage and John D. Dyer, Arizona Welding Equipment Co., Phoenix; and W. A. Borrie, Kaiser Aluminum & Chemical Corp., Oakland, Calif.

• • •

Mig-welded jack

—Linde Air Products Co.

MIG (metal inert-gas) welding speeds fabrication of heavy-duty hydraulic aircraft jacks by Regent Jack Mfg. Co., Downey, Calif. Here bracket is welded to hydraulic cylinder rotated under the torch. Wire is fed automatically into the weld area. Welding speeds range from 20 to 60 ipm

ARCAIR TORCH is 80% faster . . . in gouging and cutting for SOHIO

One of the most satisfactory pieces of equipment for speeding up maintenance work at Sohio Petroleum Company's Latonia Refinery has been the Arcair torch. This torch has saved Sohio up to 80% in time and money where a repair job involves the gouging, cutting or removal of metal.

The maintenance department of the Latonia Refinery has been using the Arcair torch for three years . . . the seven torches in operation throughout the plant find daily use in gouging out defective welds, removing steel plates for vessel repair, cutting steel and alloy castings, gouging ring joint pipe flanges for alloy deposit welding and for miscellaneous cutting of metals.

A worker at Sohio uses the Arcair torch to gouge out welds in the mild steel bottom plates of a 55,000-barrel floating roof tank.

At Sohio the Arcair torch has replaced the use of pneumatic chipping tools and arc rods for the majority of cutting, gouging or metal removal jobs. Before, it was a matter of chipping, which was slow, or burning, which produced undesirable slag. The maintenance department found the Arcair torch was fast and removed slag without the necessity of going over the work a second time . . . a jet of compressed air blows away the slag, leaving a clean, even surface. In most cases, further chipping or grinding is not necessary.

If gouging and cutting metals is a regular part of your plant maintenance operations ask your welding supply dealer how you can realize similar savings in time and money with the Arcair torch. He will be glad to arrange an actual demonstration in your plant. Write for free bulletin and the name of the nearest Arcair dealer in your area.

ARCAIR COMPANY
427 South Mt. Pleasant Ave.
Lancaster, Ohio

Arcair TORCH
Cuts all metals—using only electric arc and compressed air

Movie on Tig welding released by Air Reduction

"Nothing But the Best" is the title of a 20-minute color and sound movie produced by Air Reduction Sales Co., New York City. It tells the story of Airco's Tig (tungsten inert-gas) welding process.

Typical applications of the process —production scenes were shot in customers' plants—show manual, semi-automatic and completely mechanized equipment in use.

* * *

U. S. Steel increases output of oil tubular products

A two-fold program to increase production of oil country tubular products and to meet future requirements of the oil industry was recently announced by National Tube Div. of U. S. Steel Corp. National Tube was to start work immediately on facilities designed to triple its production of deep-well casing at National Works in McKeesport, Pa. This pipe, a 110-000 lb minimum-yield strength casing, is being used increasingly in the oil industry. As an aid to increased output additional equipment will be installed for treating and finishing the pipe in the seamless pipe mills. The new equipment is expected to be in production in about a year.

* * *

New firm enters pipe fabrication field

The recently formed Herrick-Bradley Engineering will specialize in fabrication of piping for the oil, chemical and atomic energy industries at its plant in Norwalk, Calif. The fully equipped site features the latest in automatic welding equipment and turning fixtures. Bending facilities include conventional bending tables and mechanical bending equipment. Extensive materials handling is provided by overhead crane facilities and an industrial railroad.

* * *

Visit WELDING ENGINEER's

Booth 102 at the

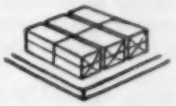
WELDING SHOW

MUNICIPAL AUDITORIUM

Kansas City, June 8 - 10

Stops moisture pick-up

Cut costs 4 ways with DryRod Method!



1 Store sealed cartons in warm, dry place.

3 Locate DryRod as close to welding operations as possible.

2 Place unpackaged electrodes in DryRod Oven and withdraw as needed.

4 For flexible, large-volume storage, stack ovens with compact DryRod Stands.

Your cheapest insurance against wasteful defective welds is DryRod. This oven protects low-hydrogen, austenetic, and other special alloy electrodes, as well as the new iron powder contact rods, against moisture.

DryRod contributes to steady welding, less slowdown, less re-work, less scrap. It can pay for itself out of rod salvage alone. Operating cost is less than 15c per 24 hours.

DryRod is completely wired, ready for use. Automatically controlled temperatures adjust from 175° to 550° F. for storage or re-baking.

Three sizes available . . . 10-lb.-capacity portable . . . standard 350 lb. (shown here) . . . large 900 lb. Type 300 and 900 quickly convert for pre-heating, drying, tempering, drawing of small die parts, and other industrial uses.

DryRod—Trademark X-DR-16

For details, see your welding supply dealer or write . . .

DryRod DIVISION OF **Phoenix Products Co.** 4715 N. 27TH ST., MILWAUKEE 16, WIS.

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Silver Brazing Alloy preforms for Production Brazing. Rings, Stamped or Coined Washers and Wire Forms

All inquiries given immediate attention and shipments made on short notice. Technical service men are available to assist you in proper joint design. Silvaloy brazing alloys also available in wire, strip, and powder from stocks in six branch warehouses.

1200 FLUX

Use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel, Inconel and other Nickel alloys. Furnished in ½ lb., 1 lb., 5 lb., 30 lb., and 65 lb. containers.

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POSITIVE LOCK!

JUST LIKE THE
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CABLE CONNECTORS

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- Locks Tight!
- Stays Tight!
- No Spring Action!
- Releases Easily!

Exclusive Cam-Lok design guarantees positive, vibration-proof connection. Locks tightly in about ½ turn. No spring tension, no weaving or moving of contact surfaces, therefore, no arcing, burning, or freezing.

COMPARE POSITIVE LOCK and these CAM-LOK features with your present connectors:

1. High Pressure contact eliminates overheating and current losses.
2. Connects instantly, all cables from #2 to 4/0 without adaptors and without tools.
3. Self-compensating for wear, self-cleaning.
4. Fiber insulation pin, arcing impossible.

"QUICK-DISCONNECT"
ELECTRODE HOLDERS
Obsolete all others!

Eliminate need for whips and whip end!

CHECK THESE FEATURES:

- Eliminates need for carrying whips.
- Holder plugs in quickly and easily to any cable merely by attaching holder handle to cable end.
- Less money tied up in cables.
- No electrician and no tools required to change holders.
- Holder and jaws insulated with tough, heat-resistant fibre glass.
- High pressure positive lock.
- Offset jaws eliminate rod banding.
- Offset holder permits burning rods to shorter stubs.
- Choice of offset or straight jaws.

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AWS WELDING SHOW KANSAS CITY

AISC to increase aid to members, others

The American Institute of Steel Construction has expanded its engineering department to provide more comprehensive assistance to its members, architects, consulting engineers and others who use its technical and research services.

Under the new plan, each of the 18 district and field engineers will report to one of five regional engineers with offices in Philadelphia, Atlanta, Chicago, Dallas and Los Angeles. They in turn will be supervised by Mace H. Bell, newly appointed chief of district engineers, who has served in New York as assistant to the director of engineering since 1950.

* * *

Welded aluminum dump body allows greater payloads

By saving almost 50% of the weight of a comparable structure, an all-welded aluminum dump body allows greater payloads under legal loading limits. Manufactured by Penn Body Div., Hockensmith Corp., Penn, Pa., the body equals the conventional dump body in all important strength factors while permitting a definite decrease in weight. The bodies, which will be available in lengths from 12 to 22 ft, will allow savings of from 1,800 to 3,000 lb.

The welds on the aluminum body, made with the latest inert-gas-shielded arc methods, are said to be comparable in appearance to the best steel welds.

—Courtesy Aluminum Co. of America

* * *

X-ray inspection

X-RAY machine was specially designed and manufactured for The Warnock Hersey Co., Ltd., Montreal. By use of this equipment, full X-rays can now be made in the field. Shown is an examination of a welded penstock section. The new Canadian firm is a result of a merger between Charles Warnock and Co., Ltd., and The Hersey Laboratories Ltd.

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ON MARKET'S MOST VERSATILE
1-ROD MAINTENANCE DEPARTMENT

ALL-STATE ALLOYS FLUXES

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NICKEL-SILVER BRAZING ROD
BRAZES 14 METALS...

Steel
Stainless Steel
Monel
Nickel
Copper
Brass
Bronze
Cast Iron
Wrought Iron
Carbides
Tool Steel
Low-Carbon Steel
High-Carbon Steel
Manganese Steel

HAS THESE MANY INCOMPARABLE CHARACTERISTICS

Tensile Strength, 85,000 psi
Shear Strength, 160,000 psi
Elongation in 2", 12.0%
Brinell Hardness, 180
Flows Like Silver Solder
Resists Wear 5 times Better Than Steel
Bonds at 1450 F
Takes Less Heat
Takes Less Preparation
Takes Less Cleaning
Finishes Jobs Faster

A LITTLE DOES A LOT MORE

No. 11 Costs Less Per Job
No. 11 Goes Further—Usually 3 times
No. 11 Saves Gases—Up To 50%
No. 11 Saves Time —Up To 60%
No. 11 Saves Dismantling
No. 11 Saves Reassembly

Comes Bare and Flux Coated
Sold by 700 All-State Distributors

SEND FOR Complete Application Instructions
ALL-STATE WELDING ALLOYS CO. INC.
WHITE PLAINS, N. Y.

Giant hangar work platforms made for Air Force

A giant "erector set" of hangar work platforms tailored to maintenance needs of seven aircraft models and interchangeable among them has been developed for the Air Force by Luria Engineering Co., Bethlehem, Pa. Aimed at speeding up and facilitating maintenance in wing hangars, the set of platforms has only 52 different basic parts to assemble. The platform sets, fabricated from heavy rolled steel wide-flange beams with welded connections (making only bolting necessary for erection), are in production at the Luria plant.

* * *

Improvement of steel mills cost $680 million in 1954

Expenditures totaling $680,000,000 were made last year by the iron and steel companies of the United States in improving and expanding their plants, according to the American Iron and Steel Institute. This was in addition to the $5,600,000,000 which the companies had already spent for new equipment and construction during the eight postwar years, 1946 to 1953 inclusive.

* * *

Students and engineers meet at OSU conference in May

Alumni, faculty and students of the College of Engineering at Ohio State University will meet again with practicing engineers and architects from business and industry to review technical developments of the past year and to look ahead together to the challenges facing engineers during the coming year. This year ACE (Annual Conference for Engineers) will be held May 6, at the Ohio Union Building, Columbus, Ohio.

* * *

Distributor appointments

Cleaver - Brooks Co., Milwaukee: Ruffridge - Johnson Equipment, Inc., Minneapolis.

Fielden Instrument Division of Robertshaw - Fulton Controls Co., Knoxville, Tenn: Electro Products, Inc., Indianapolis, Ind.

General Ceramics Corp., Keasbey, N. J.: The Irv. M. Cochrane Co., Los Angeles.

International Rectifier Corp., Segundo, Calif.: Dale G. Weber Co., Portland, Ore.

K-G Equipment Co., Inc., Allentown, Pa.: Tennessee Welding Supply Co., Knoxville, Tenn.; Welders Service & Sales, Cincinnati.

McKay Co., Pittsburgh: Williams and Wilson, Ltd., Montreal.

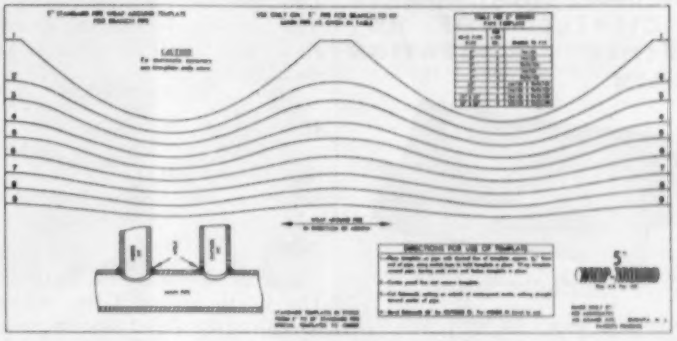
WRAP-AROUND
REG. U. S. PAT. OFF. TEMPLATES

THE INEXPENSIVE AID TO ACCURATE PIPEFITTING

You Get
- A Perfect Fit
- A Faster Job
- A Better Welding Joint
- Less Rejects

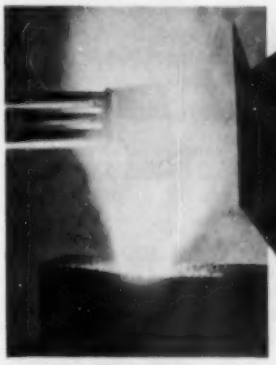
You Save
- Time
- Labor
- Material
- Recutting

FOR ALL STANDARD PIPE SIZES FROM 2" — 20"



Simply Wrap Template Around Pipe, Tape in Place and Centerpunch Contour Line Desired for a Perfect Layout

Made only by REE ASSOCIATES Bogota, N. J.



This test proves that
K-G TORCHES
have "what it takes"!

M38 Torch beginning cut in wooden "two-by-four". Note how intense heat envelopes head of torch.

Note unchanged condition of torch head after "two-by-four" has been penetrated.

Cutting through a wooden "two-by-four" is a tough test for any torch. Yet, as shown in the two photographs, our M38 Torch came through with flying colors.

Wood, unlike metal, conducts heat very slowly away from the cut. The concentrated heat reflects backward over the head of the torch. The Monel head of the M38 Torch resists distortion from this intense heat and the gas passageways remain operative.

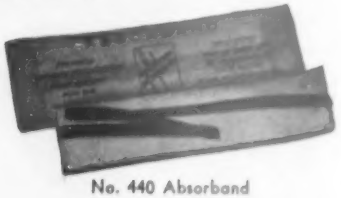
It will be found even after such an extreme test as this that the M38 head will still take a new cutting tip. NO DISTORTION HAS OCCURRED.

If you want the best in cutting and welding torches call your K-G Distributor, or send for 24-page catalog.

The K-G Equipment Co. (Inc.)
Dept. A 1744 Lehigh St., Allentown, Pa.

sellstrom safeguards designed for comfort

NOW! ORDER SWEAT BANDS TO EFFICIENTLY STOP HOT WEATHER PERSPIRATION PROBLEM



No. 440 Absorband

Industrial workers are far more efficient if they can do their work without being forced to stop frequently to keep hot weather perspiration from running into their eyes.

Sellstrom recommends that you order at once your 1955 supply of the No. 440 "Absorband" felt sweat bands. They are made from the finest absorbent white felt, treated to take in more perspiration than ordinary felt. Absolutely free from all substances to which people might be allergic.

When saturated with perspiration, it can easily be rinsed in water, wrung out and used again. Before using this sweat band, it should be dipped into water and squeezed out as it will absorb more perspiration moisture when it is wet. Each "Absorband" is in an individual sanitary envelope.

During the past few summers the sale of this sweat band has grown enormously. Each year former buyers repeat while there are always a number of new users. This is natural as the use of "Absorband" greatly increases working efficiency and comfort. Because of the low cost, each "Absorband" can actually pay for itself half-a-dozen times a day. Production is materially increased since workers do not stop every few minutes to use a handkerchief to wipe the perspiration from their forehead. "Absorband" should be a hot weather "must" in every industrial plant.

If your dealer does not handle this "specialty," write us direct for prices and a free sample for test purposes.

sellstrom MANUFACTURING COMPANY

Eye and Face Safeguards Designed for Utmost Comfort

226 Hicks Road Palatine, Illinois

30 YEARS AGO

(Taken from *The Welding Engineer* of April, 1925)

The Bastian-Blessing Co., Chicago, recently announced a new torch in its line of oxyacetylene welding and cutting torches.

—30 YEARS AGO—

The Portsmouth Oxygen Corp. will construct a new plant on the Belt Line Railroad at Portsmouth, Va. The new plant will include a welding shop, said Louis Rosenstein, president.

—30 YEARS AGO—

H. S. Card, managing editor of WELDING ENGINEER, spoke on the purpose of welding instruction before a night welding class at Carnegie Institute of Technology, Pittsburgh.

—30 YEARS AGO—

The C. H. Hollup Corp., Chicago, took over the direct sale in the area of the electric welding wire and accessories formerly sold by the Transportation Engineering Corp.

—30 YEARS AGO—

A. F. Dillon's book, "Railroad Welding," which has illustrations and descriptions of the different standard designs of welds with indications of the important uses of each design, was recently published.

—30 YEARS AGO—

After several years of development and trial, General Electric Co. is now marketing a line of automatic arc-welding equipment.

—30 YEARS AGO—

The H. Kleinhans Co., Pittsburgh, Pa., recently announced a new motor generator set called the "Mann Welder." The welding circuit of this set consists of a d-c generator with field rheostats and reactance.

—30 YEARS AGO—

Charles M. Rusk tells how one shop adopted the metallic arc method and turned what seemed to be an absolute failure into a real profit in his article, "Welding in the Ornamental Iron Works."

—30 YEARS AGO—

Because of the importance of the ready refilling of cylinders for storing compressed gas, the U. S. War Dept. has requested the American Engineering Standards Committee to undertake the unification of threads used on the valves fitted to such cylinders.

3 BIG ISSUES

of WELDING ENGINEER

in the next

2½ MONTHS

- **MAY**
  —Distributor issue
- **JUNE**
  —Statistical issue, American Welding Society meeting and welding show issue
- **MID-JUNE**
  —Fact File issue

In **May,** an eastern distributor will tell you how he runs a welding clinic and show; the pros and cons of leasing trucks will be discussed in another feature; and the complete program for the National Welding Supply Association's 11th annual convention will be given in a one-page story.

The **June** issue will include Welding Engineer's annual statistical round-up of the welding industry. In June, you will also read about the program of the American Welding Society's spring meeting and show in Kansas City.

The annual directory issue, **Mid-June,** will bring you even a better welding industry "bible" than in past years, with **7 BIG** sections—Arc, Gas Resistance, Grinding, Metals, Safety, Shop Equipment.

In addition to these special articles and stories, a wealth of new and valuable information will be found in the regularly scheduled department columns.

Watch for

May, June and Mid-June!

Abrasive wheels

WHY DO ABRASIVE CUT-OFF WHEELS FAIL? (SOMETIMES). Published by Wallace Tube Co., Chicago, 1954. Paper, 5½ by 8½ in., 38 pages. Price 50 cents; free if requested on company letterhead.

Why abrasive wheels sometime fail and how to prevent such failures is explained in this well-illustrated booklet. It also explains how such wheels cut to produce quality cuts. Not only are wheel speeds, bearings, etc. covered, but the book advises proper storage and care prior to usage. The book, however, does not touch upon the subject of abrasive grinding, only cutting.

• • •

Tool design

ELEMENTARY TOOL DESIGN. By Elmer B. Benson. Published by Chas. A. Bennett Co., Inc., Peoria, Ill., 1954. Cloth, 7 by 10 in., 224 pages.

The author of this elementary book on tool design assumes that those interested in the subject have a knowledge of mechanical drawing and general machine shop practice. The text material is divided into chapter units which develop progressively.

Chapter units begin with the fundamentals needed for understanding and applying the drawing technics and design principles of various types of tools as they are discussed. Technical discussions have been avoided; drawings and photographs have been selected to explain and emphasize the text material. Carefully chosen questions and practical problems not only stimulate design qualities, but are thought provoking.

While welding is discussed in connection with fabrication of jigs and fixtures, the design of jigs and fixtures for welding is not included.

Western Metal Specialty buys Crippen Machine and Tool

Western Metal Specialty Co., Milwaukee, recently bought Crippen Machine and Tool Co., Jackson, Mich., manufacturer of small fuel tanks. Seven acres of land adjoining the Crippen plant have been purchased along with the additional machinery. This addition will allow for future expansion.

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STAINLESS STEEL
WELDING WIRE

▶ available in Spools, Coils and Lengths

▶ for Automatic and Semi-Automatic gas and inert arc welding

Welding wire by Drawalloy is made to an exacting high standard . . . a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction *before* you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

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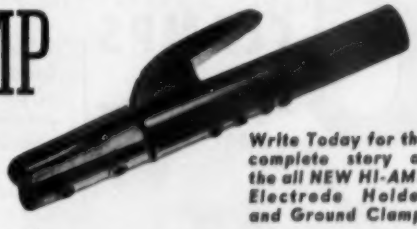
If You'll Just Check the EXCLUSIVE Advantages of the

NEW HI-AMP
ELECTRODE HOLDER—
you won't use any other type!



Write Today for the complete story of the all NEW HI-AMP Electrode Holder and Ground Clamp.

- Spring completely enclosed and insulated. Cannot be knocked or shorted out.
- Spring Adjustment Screw for ease of replacement and adjustment to rod size.
- Handle cannot absorb moisture—withstands higher temperatures.
- Tip insulators reversible for longer service life.
- Low Trigger for ease of Rod relief—cuts down operator fatigue.
- Slender rod gripping tongs to get in tight places.

and that goes for Ground Clamps, too!

- Spring cannot be knocked out.
- Spring adjustment screw for easy replacement or adjusting.
- Sturdily built for excessive abuse.
- Designed especially for all-round welder's needs.

Sold only through Welding Supply Distributors throughout the U.S. and Canada

WAGNER MANUFACTURING CO.
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Weld with Wagner

Make More Money on EVERY Welding Job..

METAL BOND
SOLDERING AND WELDING
PRODUCTS

We have been making Metal Bond Products for more than 25 years and successful Welders all over the country have been using them to advantage.

METAL BOND
METAL BOND MFG. CO. St. Louis, U.S.A.

AIDS TO GOOD WELDING JOBS

- Tinning Compounds
- Soldering Salts
- Hard Metal
- Aluminum Solder
- Mouldough
- Brazing Flux No. 10
- Special No. 31
- Seal-X-O
- Cast Iron Welding Flux No. 4
- All Steel Wire Brushes and Holders.

- Make your own test—also send for our pocket-size catalog which contains information and descriptions of our money-saving METAL BOND Products.

METAL BOND MFG. CO.
MONTGOMERY CITY, MO.
P.O. BOX 215

insist on famous "Jorgensen" AND "Pony"

CLAMPS

Ask your supplier

SEND FOR FREE 32-PAGE CATALOG.

ADJUSTABLE CLAMP CO.
"The Clamp Folks"
426 No. Ashland Ave. • Chicago 22, Ill.

Laurence G. Holfelder and *James A. Coleman* have been appointed abrasive engineers by Norton Co., Worcester, Mass. Holfelder will cover the central Indiana territory, and Coleman has been assigned the Kansas City, Mo., area. *Raymond B. Goodale* has been named field engineer at the company's Chicago office. In two territory changes, *William A. Simonds* will take over the northern Texas area, and *Paul B. Foxwell* will shift to southern Texas.

* * *

Theodore Z. Herr has been appointed chief engineer of the American Welding & Mfg. Co., Warren, Ohio. Mr. Herr, who has been chief engineer of the Building Products Division, will now be responsible for all phases of plant, industrial-products and institutional-products engineering.

* * *

Four changes in its Western Division were recently announced by Tube Turns, Louisville, Ky. *L. O. Morris*, formerly sales representative in Denver, has been made new district manager of the mid-continent territory, with headquarters at 305 Wright Building, Tulsa. *Daniel V. Pisano*, formerly a member of the sales staff of the New York office, has been appointed manager of the San Francisco district. His office is in the Russ Building. *Norton P. Bosemer*, formerly manager of the Los Angeles office and plant, has been promoted to district manager of the Los Angeles territory. *E. R. Muir, Jr.*, formerly sales representative at Seattle, has been appointed district manager of the Northwestern territory, with headquarters at 3017 43rd St., West, Seattle. Before the several staff changes were made, the Los Angeles and Seattle offices operated under the San Francisco office.

* * *

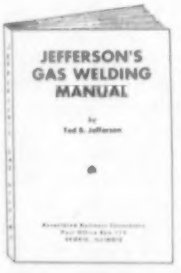
Niles L. Kohler has been appointed plant manager of American Chain & Cable Co.'s malleable iron foundry at York, Pa., a unit of the firm's American Chain Division. *Earl S. Lathrop* was recently named plant manager of that division, and *H. L. Cummings* is his assistant.

United States Steel Corp.'s South Chicago plant recently made seven appointments. They are: *George S. Mican*, assistant to the general superintendent — engineering; *Francis A. Snyder*, division superintendent of rolling—structural; *George W. Boase*, assistant division superintendent of rolling—plate and bar; *Leon E. Fuller, Jr.*, division superintendent of rolling—plate and bar; *Alfred T. Gilbert*, assistant division superintendent of maintenance; *John P. Marner*, assistant chief engineer; and *Elmer I. Pearson* (acting) works assistant chief engineer.

* * *

Laurence W. Hayward, former assistant chief engineer of the Boiler Division, The Babcock & Wilcox Co., has been named manager of the newly-created Contract and Erection Department. *R. W. Fox*, contract manager, and *J. P. Craven*, erection superintendent, will continue to be in charge of these respective functions, under Mr. Hayward. The department will be located in a modern office building soon to be built a short distance away from the company's largest manufacturing plant in Barberton, Ohio.

JEFFERSON'S GAS WELDING MANUAL
by Ted B. Jefferson



- 7 Chapters
- 112 Pages
- 5 x 7½ in. Size
- 39 Tables
- 67 Illustrations
- Indexed
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America's newest gas welding book and the only book with —

- Jiffy Welding Guides
- Jiffy Flame Cutting Guides
- Jiffy Joining Chart

Other chapters on How to Weld; How to avoid Defective Welds; Flame Cutting; Flame Treating and Useful data for the Welder.

Order from your

Welding Supply Distributor
or
Welding Engineer
12 E. Grand Ave., Chicago, Ill.

Eugene Easterly and *E. G. Hickling* have been named vice-presidents of distribution and operations, respectively, by Linde Air Products Co., New York City.

* * *

Jerome M. Roth has been named regional manager for All-State Welding Alloys Co., Inc., White Plains, N.Y., to cover the states of New Jersey, Delaware, and Maryland and the contiguous areas of Virginia, Pennsylvania and West Virginia. He is a member of the American Welding Society and before joining All-State was with Ajack Mfg. Co.

* * *

E. E. Anderson was recently appointed vice-president of Metal & Thermit Corp., New York. He has been with the firm for more than 40 years. Since 1940 he has headed the company's operations in the western states and will continue to act as its top management executive on the Pacific Coast.

* * *

Vernon C. Robinson has joined the Development and Research Division of The International Nickel Co., Inc. as a member of the Twin Cities Technical Field Section at Minneapolis.

* * *

Robert C. Olney has been promoted to eastern regional sales manager of commercial trades, reflective products division, by Minnesota Mining & Mfg. Co., St. Paul. He will work out of the division's Chicago office.

* * *

Paul A. Pitt was recently named chief engineer of Solar Aircraft Co., San Diego, and *William C. Heath* was appointed executive engineer—marketing.

* * *

Edward B. Story recently retired from A. M. Byers Co., Pittsburgh. He had been with the firm for 38 years and is being retained by the company as a consultant. He helped develop the Byers process for manufacturing wrought iron.

* * *

William J. Ryan has been appointed assistant to *Herbert T. Florence*, executive vice-president and general manager of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

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CARBON
WELDER BRUSHES

for all types and makes of welding equipment

Everything you need from *one* source, with *one* responsibility. The fast, economical way to order. Catalog gives complete specifications, factory numbers, scaled drawings, etc. Write for your free copy today.

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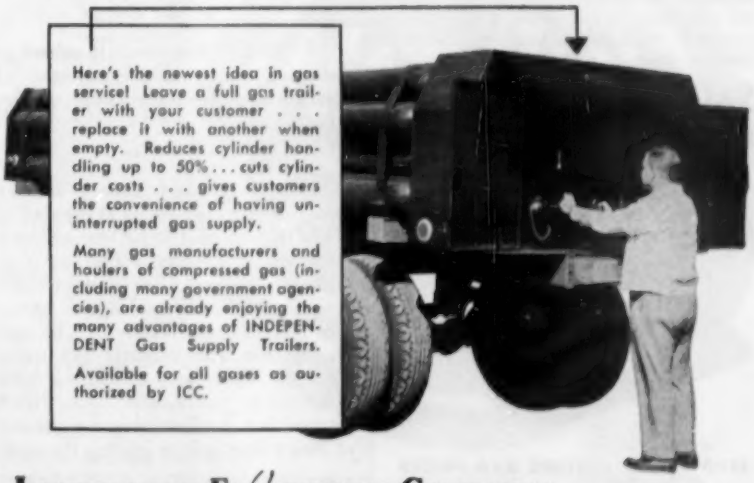
Here's the newest idea in gas service! Leave a full gas trailer with your customer . . . replace it with another when empty. Reduces cylinder handling up to 50% . . . cuts cylinder costs . . . gives customers the convenience of having uninterrupted gas supply.

Many gas manufacturers and haulers of compressed gas (including many government agencies), are already enjoying the many advantages of INDEPENDENT Gas Supply Trailers.

Available for all gases as authorized by ICC.



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Manufacturers of
CONSULTING · DESIGNING · RESEARCH
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN
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We Invite Your Inquiries

We all can't get into the ad

but here are four of our family of 25 FLUXINES. 50 years of scientific research enable us to give you the particular FLUXINE you need.

"Complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys."

No. 18C FLUXINE —for gas welding of stainless steels, inconel and nickel chrome alloys.

No. 47 FLUXINE For silver soldering aluminum bronzes, manganese bronzes, beryllium copper and brass.

No. 20 FLUXINE For spelter brazing brass, bronze, copper and steel.

No. 89 FLUXINE —for tinning and soft soldering, soluble in water, 1 lb. makes 1 gallon.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

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(Est. 1875)
Dept. J, 669 W. Ohio St., Chicago 10, Ill.

Boat Trailer Manufacturers!

Here's an accessory that will really help sell your boat trailers. A *solid brass* winch for little more than you'd pay for steel or aluminum.

This low-cost Feik Winch can't corrode . . . will last for years. Rugged, yet precision-made. Minimum capacity, 800-lbs. direct lift. Available in 2 types, at quantity prices.

Solid Brass!

The most copied winch in America

PAT. PENDING

SEND FOR LITERATURE AND PRICES

W.G. FEIK *Marine Products*

Dept. W • 1809 Alton • Houston 24, Texas

Sidley O. Evans has been appointed to the newly created position of manager of tubing operations of The Babcock & Wilcox Company's Tubular Products Division plant, Beaver Falls, Pa. *David A. Edgecomb* has been named to succeed Mr. Evans as superintendent of the extrusion department.

* * *

Edward F. Harbison has been appointed special representative for liaison with USAF's Air Material Command and Wright Aeronautical Development Center, Dayton, Ohio, by The Aeronautical Division of Robertshaw-Fulton Controls Co., Anaheim, Calif.

* * *

Paul H. Butterfield, who has occupied key positions with Nelson Stud Welding, Lorain, Ohio, in various parts of the country since 1944, has been named specifications specialist for the firm in New York City.

* * *

Myron T. Bennett was recently promoted to promotional manager of Metal Industries Dept. by The Diversey Corp., Chicago. Previously, he was general manager of the Spec-Kem Co.

* * *

Charles H. Hallett has been appointed assistant sales manager for the Chicago plant of Joseph T. Ryerson & Son, Inc. *John W. Bodwell* is the new manager of the work order division. He replaces *William G. Findlay*, who has become assistant manager of the firm's plant in Detroit. *Harold W. Davidson*, a sales representative for the past nine years, succeeds Bodwell.

* * *

A. R. Hunter was recently added to the application engineering staff of International Rectifier Corp., El Segundo, Calif.

* * *

Jerome Shaffer and *Audrey Madsen* have recently been added to the staff of WELDING ENGINEER as assistant editors. *Joyce Nevis* is the new production manager. Miss Madsen holds a master's degree in English literature from the University of Chicago. Mr. Shaffer was recently graduated from the University of Illinois with a degree in journalism. Miss Nevis worked in the advertising department of *Down Beat* before joining the staff.

* * *

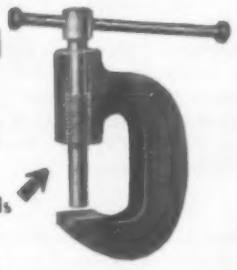
Edward L. McDonald has been appointed assistant advertising manager for Kaiser Aluminum & Chemical Corp., Oakland, Calif.

BUY SELL USE

SHAWINIGAN CARBIDE

SHAWINIGAN PRODUCTS CORPORATION
EMPIRE STATE BUILDING
NEW YORK 1, N. Y.

"Red Head"
WELDING CLAMPS



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No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

Sherwood J. Basch has been named chief engineer of the machine tool division of Morton Mfg. Co., Muskegon, Mich.

* * *

F. L. Blodgett was recently promoted to general sales manager of Alloy Rods Co., York, Pa. He joined the company in 1950 as sales manager of the hardfacing and tool steel division, later advancing to the post of assistant general sales manager.

* * *

Philip H. Smith was recently elected vice-president—sales engineer for the Nooter Corp., St. Louis, a custom fabricator of steel and alloy plate, storage tanks and pressure vessels for the chemical, petroleum and related process industries.

* * *

C. P. Lavelle has been appointed division manager of Hygrade Metal Finishing Division of United States Hoffman Machinery Corp., New York City. The division designs, builds and installs mechanized automatic and semi-automatic systems for the cleaning and finishing of metal parts. It also makes pressure vessels and weldments for the process industry.

* * *

Howard N. Farmer, Jr., has joined the Development and Research Division of The International Nickel Co., Inc., as a member of the West Coast Technical Field Section at Los Angeles.

* * *

Died . . .

Fred Archer, president of Fred C. Archer Inc., Milwaukee, died March 8 after a prolonged illness.

* * *

Francis G. (Frank) Jones, Chicago regional manager for All-State Welding Alloys Co., Inc., White Plains, N. Y., was killed in an automobile accident just outside of Chicago on March 11. Frank Jones had long been associated with the welding industry in the Chicago area. At one time he was with Liquid Carbonic Corp. and more recently was branch manager for Victor Equipment Co. He has been with All-State since last November.

Oxygen-Nitrogen from Air

Air SEPARATOR for producing high purity oxygen and nitrogen.

SUPAIRCO

PLANTS AND APPARATUS

- Simple to install
- Easy to operate
- Rugged construction
- Minimum maintenance

We have installations all over the world. Let us know your requirements. We will be glad to furnish detailed specifications and prices.

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Also manufacturers of plants for producing liquid oxygen—liquid nitrogen—liquid air also Storage and Transport Containers for all liquefied gases.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

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A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

When You Weld Cast Iron
Select the Correct

Fuse-Well

CAST IRON WELDING RODS
OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

Sold through Leading Distributors

THE CHICAGO HARDWARE FOUNDRY CO.
Weld-Rod Division
NORTH CHICAGO, ILLINOIS

The Champ of Clamps!

THE GRAND QUIKCET DUAL GRIP TYPE "AS"

Quick setting double-action clamp grips work more securely. Holds irregular and off-parallel surfaces as well as flat work due to pincer action. Easily tightened in cramped areas.

4 SIZES: 2½" TO 6" OPENING
SPATTER-PROOFED—NACO NO. 6 STEEL
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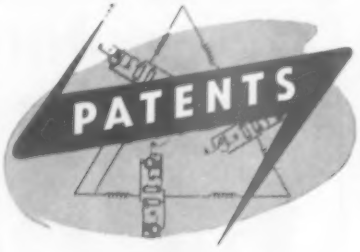
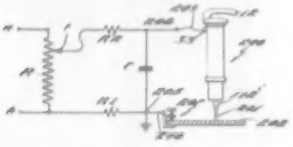


Welding system

2,685,630. HAROLD J. GRAHAM, Highland Park, Mich. Assigned to Graham Mfg. Corp., Detroit. Filed Oct. 26, 1949. Granted Aug. 3, 1954.

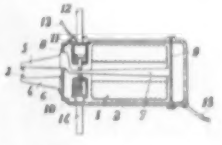


This patent covers a system whereby a stud or wire is welded to a surface. One end of the stud is shaped with a point, which comes in contact with the surface. A current is sent through the stud and surface while applying a percussive blow thereto. The current initially melts the material of the contact area. This separates the point from the surface, and an arc is formed whereupon the blow joins the end to the surface.

* * *

Resistance welding

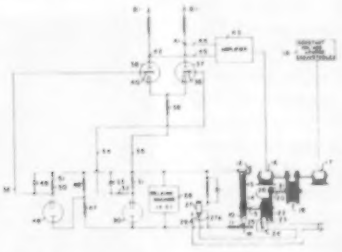
2,678,367. KUNO EISENBURGER, Wels, Austria. Assigned to M & S Maschinen Und Stahl A. G., Zollikon-Zurich, Switzerland. Filed Aug. 27, 1949. Granted May 11, 1954.



An electrical resistance welding machine for spot and seam welding is covered by this patent. The casing of a supply transformer forms an essential portion of the secondary of said transformer. The electrodes are connected with the peripheral surface of the casing without articulations by holding means. The holding means of at least one of the electrodes comprises at least one resilient part; the holding means of both electrodes is otherwise rigid. An elastic partition, inserted into the casing, is connected to one of the electrodes by an arm. A bag is arranged in the space between the bottom of the casing and said partition. A means is provided for supplying a pressure medium to the bag.

Automatic welding

2,671,869. RICHARD B. STEELE, New Providence, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed July 13, 1950. Granted March 9, 1954.

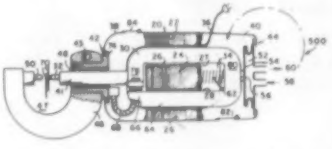


An automatic arc-welding apparatus and method are covered by this patent. Welding circuit includes an electrode and the work for supplying current to maintain the welding arc. An electrode-moving means automatically adjusts the spacing between tip of the electrode and work. This means is responsive to variations in the arc voltage during welding to maintain the arc length constant and the arc voltage at a corresponding normal value. A voltage divider is connected in parallel to the arc. A capacitor is connected across one section of the divider which is charged when the welding circuit is energized and before the arc is established. Also provided is a means, responsive to the capacitor charge and to the discharging of the capacitor after arc is established, for counteracting the effect on said electrode-moving means of the increment of arc voltage above the normal value which exists during interval electrode is heating up.

* * *

Portable spot welder

2,677,744. WOLFGANG B. FAHRENBACH, Oakland, Calif. Filed April 27, 1950. Granted May 4, 1954.



This patent concerns an electrical welding tool comprising, in combination, a transformer with a hole through it, a means providing fixed and movable welding tips that are positioned adjacent the transformer at one end of the hole, and a motor positioned adjacent the transformer at the other end of, and outside, said hole. A means, which extends freely through the hole, extends to the movable welding tip and to the motor for driving the tip by the motor.

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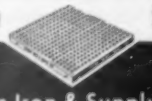

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1. WELDING NEWS—Cecil C. Peck Co. "Tooling for Welding" depicts standard tooling, fixtures and machinery for welding.

2. CABLE CONNECTION—Erico Products, Inc. One of a series of booklets with this one stressing permanency as a basic requirement of a good electrical connection.

3. ELECTRODE—Ampco Metal, Inc. New electrode for welding manganese bronze and yellow brasses is described in leaflet.

4. GRINDING WHEELS—Grinding Wheel Institute. 4-page bulletin lists 20 safety precautions which each grinding-wheel user should check.

5. ARC WELDER—Illumi Tronic Engineering Co. 4-page folder tells of the operation of this heavy-duty, portable a-c arc welder built for continuous production.

6. MIST COLLECTOR—Dollinger Corp. Bulletin 420 announces new machine for eliminating oil mist and smoke at its source.

7. HARDFACING—Mir-O-Col Alloy Co. "Weldor's Guide to Successful Hardfacing," is revised 72-page booklet which includes latest data.

8. OXYACETYLENE WELDING — Air Reduction Co., Inc. Catalog 9-13 covers line of arc and oxyacetylene welding supplies and accessories.

9. EYE SAFETY—Watchemoket Optical Co. Bulletin 100RR includes new developments in protective equipment.

10. A-C MOTORS—Reliance Electric & Engineering Co. "Check the Facts" booklet points out 100 characteristic facts of the new line of totally protected motors.

11. CUTTING TORCH—Arcair Co. Case history booklet shows many detailed on-the-job reports of actual usage of cutting and gouging torches.

12. RESISTANCE WELDING — Sciaky Bros., Inc. Vol. 4, No. 4 of "Resistance Welding at Work" describes method of fabrication of America's most heavily armed fighter.

13. HARDFACING—Rankin Mfg. Co. 8-page catalog (Form B-5) tells "Why" and "How" hardfacing should be applied to obtain best results.

14. NICKEL ALLOY—Alloy Metal Wire Co. Wall chart designed to help in selection of proper nickel alloy in wire, rod and strip form.

15. INDUSTRIAL FANS—Chelsea Fan & Blower Co. Bulletin 600-55 gives information on various products such as fans and blowers.

16. METAL MELTING—General Electric Co. Bulletin GEA-6113 is guide for selection of heating equipment and control for soft-metal melting applications.

17. POWER PIPING—M. W. Kellogg Co. 12-page pamphlet depicts methods of stress analysis, metallurgical research, etc.

18. BRONZE ELECTRODE — Ampco Metal, Inc. Comparison chart lists all known brands of bronze electrodes.

19. RESISTANCE WELDING—Taylor-Winfield Corp. No. 551 of "Weld-It" describes welding of aluminum extrusions for aircraft and droppable tanks.

20. WELDING HEAD—Mir-O-Col Alloy Co., Inc. 4-page leaflets tells advantages of this automatic head said to achieve faster welding at lower cost.

21. REFRACTORIES—Babcock & Wilcox Co. Bulletin R-36 is designed to provide stationary and marine boiler operators with a guide for selecting the most efficient and economical refractories.

22. A-C/D-C WELDER — Harnischfeger Corp. Bulletin W-93 describes welding machine that operates on either current just by flip of switch.

23. CLAMPS—Grand Specialties Co. 12-page pamphlet depicts different types of clamps.

24. IRON-POWDER ELECTRODES—The Lincoln Electric Co. Reprint from *Welding Journal* covers theory of the new electrodes and explains their advantages.

25. GEARS—Universal Gear Works. 200-page catalog featuring specifications and prices of over 8,000 stock items including gears, sprockets, chains, splines, etc.

26. WELDING NEWS—Eutectic Welding Alloys Corp. Recent issue of the "Weldor" depicts eight case histories of profitable "non-fusion" welding.

27. CUTTING TORCH—Universal Cutting and Welding Equipment Co. 4-page illustrated folder describes styles of cutting torches.

28. VALVES—Cooper Alloy Foundry Co. Technical paper includes 75 questions and answers that will help in selection and maintenance of stainless steel valves.

29. CRANE—Dominion Bridge Co., Ltd. Bulletin tells of newly developed single girder electric cranes having from ½ to 20-ton capacity.

30. WELDING MACHINES — Expert Welding Machine Co. 54-page, spiral-bound catalog describes and illustrates the firm's various machines and tools.

31. QUALITY CONTROL—J. W. Dice Co. Bulletin 3052 tells of microhm meter which checks "cleanliness" of aluminum or other sheet material prior to welding.

32. BRAZING—The American Platinum Works. 6-step outline gives recommended procedure for torch brazing with "Silvaloy," a low-temperature alloy.

33. SAFETY HATS—Jackson Products, Inc. Leaflet tells about cap and welding helmet combinations for protection against falling objects and sudden impact.

34. WELDERS — Hobart Brothers Co. Pamphlet J-5821 gives price information on and illustrates this firm's welders.

35. ARC WELDING—The Lincoln Electric Co. No. 133 is one of a series on structural arc welding. This one is concerned with design for a continuous girder bridge without floor beams.

36. WELDING DATA—Air Reduction Co. "Facts about Air Reduction" describes the products and services of this firm's various divisions.

37. BENCH VISES—Van Products Co. 4-page brochure describes air-powered vises and discusses their time-saving applications.

38. HEAT TREATMENT—The International Nickel Co., Inc. Bulletin A-115 tells how to increase the usefulness of cast irons and improve the properties by alloying and heat treatment.

39. BRAZING ALLOYS—Handy & Harman. Bulletin 20, "Easy-Flo and Sil-Fos," informs about low-temperature, silver-alloy brazing.

40. WELDERS—Ames Spot Welder Co., Inc. Sheet describes butt and flash welders that are air operated, adjustable and fully automatic.

41. RESISTANCE WELDING — Banner Manufacturing Co. 4-page pamphlet illustrates and describes various welding machines used for different jobs.

42. GRINDING WHEELS—Norton Co. 28-page illustrated catalog 1052 is condensed booklet that covers grinding-wheel selection in detail.

43. STEEL PLATES—Lukens Steel Co. Pamphlet concerns itself with dollars-and-cents facts about the economies possible in the use of clad-steel plates.

44. STEEL—Ryerson & Son, Inc. 24-page brochure deals with sources for every kind, shape and size of steel.

45. HEAT EXCHANGERS—M. W. Kellogg Co. 12-page booklet describes processes involving gas to gas, liquid to liquid, powdered solid to liquid, high pressures to vacuum and temperatures from 280 to 1,600 F.

46. STUD WELDING—Nelson Stud Welding. Reprint from "Product Engineering 1955 Annual Handbook" deals with ferrous and non-ferrous metals.

47. DUCTILE IRON—The International Nickel Co. Bulletin DI-15 contains illustrations, charts and tables on composition, machinability and mechanical properties of this new family of irons.

48. CYLINDERS—Miller Fluid Power Co. "A Cylinder Program for Automation and Heavy Duty Service" envisions new economies, convenience and versatility in the use of air and hydraulic cylinders.

49. ELECTRODE COATING—Shieldalloy Corp. 40-page booklet describes functions of electrode-coating ingredients.

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100. Adjustable Clamp Co.—32 page clamp catalog.
101. Air Reduction Sales Co.—Catalog 818 describes cutting torches and tips.
102. Alloy Rods Co.—Booklet on iron-powder, low-hydrogen electrodes.
103. All-State Welding Alloys Co., Inc.—Instructions for use of "No. 11" nickel-silver brazing rod.
104. American Platinum Works—Bulletin 542 is on brazing hard carbide.
105. Ampco Metal, Inc.—Bulletin No. W-17 describes "Ampco-Trode 10" electrode.
106. Arcair Co.—Bulletin on uses of gouging and cutting torch.
107. Becker Bros. Carbon Co.—Catalog describes carbon welder brushes.
108. Cam-Lok Division — Booklets on cable connectors and electrode holders.
109. Carol Cable Co.—Brochure on "Dynapower" welding cable.
110. Colonial Abrasive Products Co.—Booklet on "Grindaway" wheels for portable grinders.
111. Drawalloy Corp.—Information and prices on stainless-steel welding wire.
112. Erico Products, Inc.—Catalog on arc-welding accessories.
113. Eutectic Welding Alloys Corp.—15th anniversary "Directo-Rod" guide on better welding.
114. W. G. Feik Marine Products—Literature and prices on corrosion-resistant brass winch.
115. General Electric Co. — Bulletin GEC-1305 describes 295-amp a-c welder.
116. H & M Pipe Beveling Machine Co. —Folder tells about "More Profit Dollars in Pipe Fabrication."
117. Harnischfeger Corp. — Information on multipurpose a-c/d-c arc welder.
118. Harris Calorific Co.—Folder No. 540710 describes "Super-Heat Torch No. K23."
119. Hobart Bros. Co.—Complete information on constant-voltage, d-c arc welder for automatic applications.
120. Hobart Bros. Co.—Information on new a-c/d-c, iron-powder electrode.
121. Hobart Bros. Co.—Booklet on "How to Get Better Welds."
122. K-G Equipment Co., Inc.—24-page catalog describes cutting and welding torches.
123. Krembs & Co.—Chart and sample of "Fluxine" fluxes for soldering, welding, brazing are available.
124. Lincoln Electric Co.—Bulletin 1343 describes new "Idealarc" welder for a-c/d-c applications.
125. P. R. Mallory & Co.—Resistance-welding catalog and aids for seam-welding wheel selection.
126. Metal Bond Mfg. Co.—Catalog lists soldering and welding products.
127. Mid-States Welder Co., Inc.—Information on various arc welders.
128. Miller Electric Mfg. Co., Inc.—Information about arc and spot welders.
129. North American Philips Co., Inc.—Folder on "Elmet" tungsten electrodes.
130. Norris-Thermador Corp.—Illustrated specifications sheet for acetylene cylinders.
131. Page Steel & Wire Division—Literature and prices on welding wire.
132. Phoenix Products Co.—Details on use of "DryRod" electrode oven.
133. Sellstrom Mfg. Co.—Prices and sample of "Absorband No. 440" felt sweat bands.
134. Stoody Co.—Information on "Coated Tube Stoodite" hardfacing.
135. Sylvania Electric Products, Inc.—Technical information on three types of tungsten electrodes.
136. Tube Turns — Booklet entitled "Stainless Steel Piping . . . Why and Where to Use It."
137. Tweco Products—Data and prices on line of electrode holders, ground clamps and cable connections.
138. United States Steel Corp.—Booklet entitled "United States Steel Presents T-1" describes new alloy steel.
139. United Wire & Supply Corp.—Folder on "Phoson" brazing alloys.
140. Unitek Corp.—Brochure on stored-energy-type equipment for resistance welding.
141. Victor Equipment Co.—Illustrated manual explains applications of hardfacing alloys.
142. Victor Equipment Co.—Catalog 20 depicts welding and cutting torches and accessories.
143. Wagner Mfg. Co.—Story of "Hi-Amp" electrode holder and ground clamp.
144. Westinghouse Electric Corp.—Electrode-application chart.
145. Goldsmith Bros. Smelting and Refining Co.—GB data book on brazing alloys.
146. Tempil Corp.—Sample temperature pellets available.

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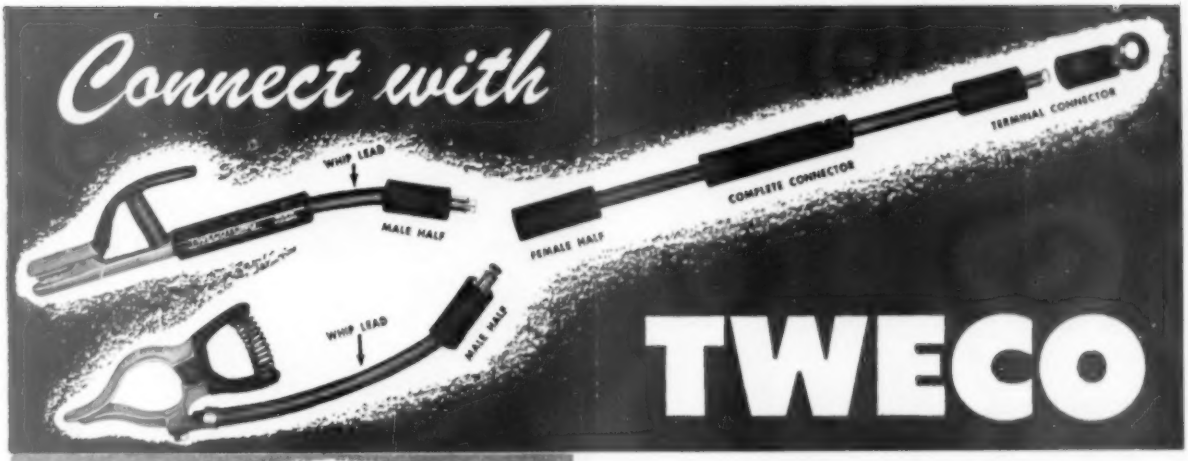

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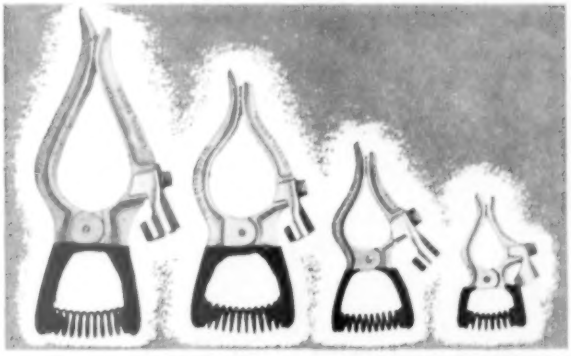

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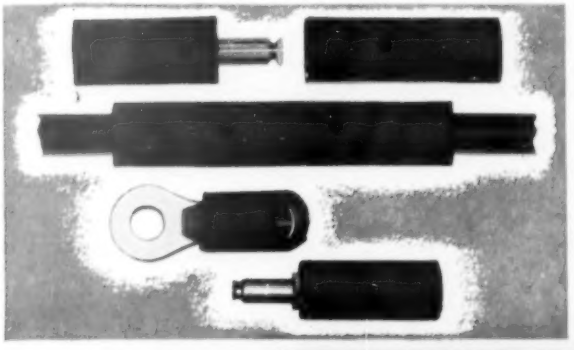

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